TM 11-289

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

RECEIVER-TRANSMITTERS RT-66/GRC, RT-67/GRC AND RT-68/GRC

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For explanation of distribution formula, see SR 310–90–1.

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WARNING

HIGH VOLTAGE

Is used in the operation of this equipment

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions

First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever-watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4

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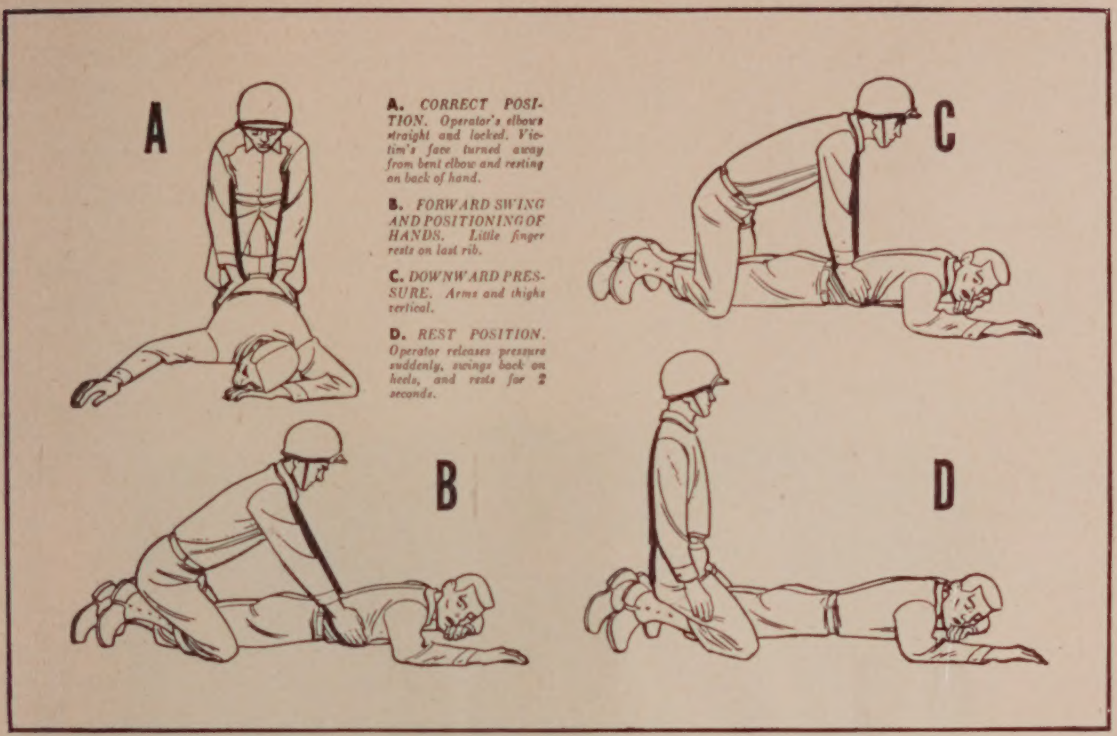
A
B
C
D
A. CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.
B. FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.
C. DOWNWARD PRESSURE. Arms and thighs vertical.
D. REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.

seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

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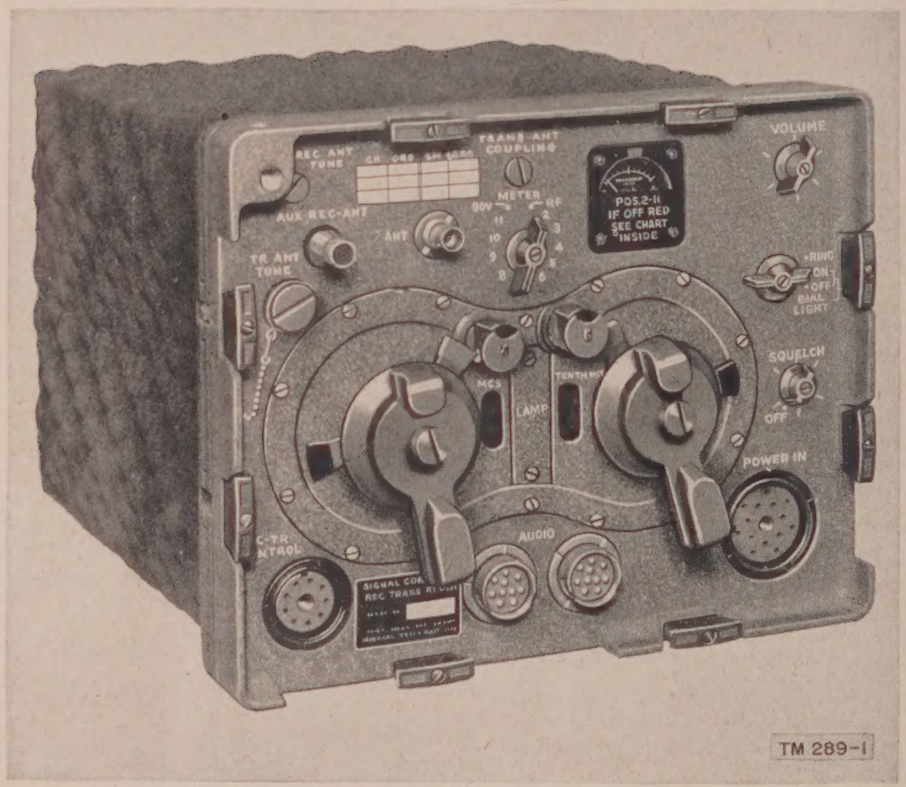

Figure 1. Typical receiver-transmitter over-all view,

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains a description, a detailed theory of operation, and instructions for field maintenance and repair of Receiver-Transmitter RT–66/GRC, Receiver-Transmitter RT–67/GRC, and Receiver-Transmitter RT–68/GRC (fig. 1). In addition, a chapter on the disassembly and repacking of the equipment for shipment or limited storage is included. Two appendixes, covering a list of references and an identification table of parts, also are provided. The illustrations are in numerical sequence except figures 24, 32, 47, 53, 54, and 55, which are included in an envelope at the end of the manual.

b. Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC are very similar in structure, function, detailed circuit, and mechanical arrangement. They differ from each other only in their operating frequency ranges and in those components which determine the frequency ranges. Unless otherwise specified, the discussions in this manual apply to all three equipments, which will be referred to as receiver-transmitters. Where specific differences exist between the units, these differences are described with specific reference to the particular unit involved.

2. Forms and Records

The following forms will be used for reporting unsatisfactory condition of Army matériel and equipment:

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5.

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. DA AGO Form 419, Preventive Maintenance Checklist for Signal Corps Equipment, will be prepared in accordance with instructions on the back of the form.

d. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use
(fig. 1)

a. Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC are compact, lightweight radio sets (without power supply and accessory components) designed for the transmission and reception of f-m (frequency-modulated) signals. The sets are arranged for use in either vehicular, semifixed, or portable installations. When suitably powered and equipped with an antenna, a microphone and a headset (or a handset), each receiver-transmitter provides two-way communication with similar vehicular, ground, or portable equipments.

b. The frequency coverage of the receiver-transmitters is indicated in the frequency spectrum chart (fig. 2). An overlap of 1 mc. (megacycle) is provided between the bands covered by Receiver-Transmitters RT–66/GRC and RT–67/GRC. Similarly, a 1-mc overlap exists between the bands covered by Receiver-Transmitters RT–67/GRC and RT–68/GRC. The purpose of this overlap is to permit establishing liaison between sets operating in different tactical units. For comparison, the chart also includes the frequency coverage of other radio equipments with which Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC may be associated in a working net. The chart shows that a considerable overlap exists between Receiver-Transmitter RT–68/GRC and Receiver-Transmitter RT–70/GRC. Each receiver-transmitter may be tuned quickly and accurately in 100-kc (kilocycle) steps to any one of the detent channels into which its operating band is divided. Alternatively, continuously variable tuning of the entire band is possible. Also, provision is made for presetting two of the detented channels by means of the mechanisms on the tuning controls.

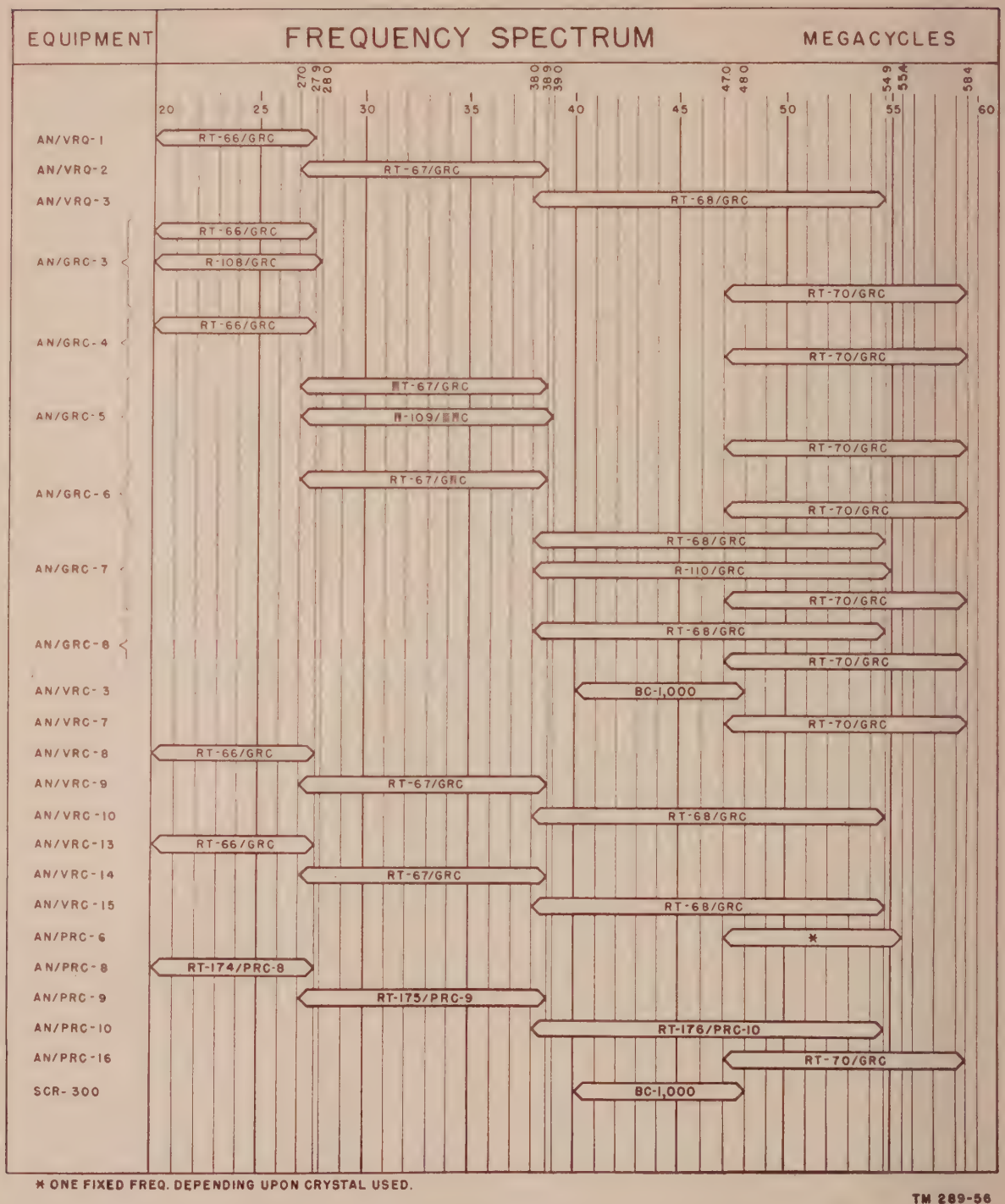

Figure 2. Frequency spectrum chart.

c. Basically, the communication circuit provided by the receiver-transmitters is of the single-frequency, push-to-talk type (fig. 3). The term single-frequency means that the receiver and transmitter circuits are gang-tuned to the same frequency. The term push-to-talk means that normally the equipment is in the stand-by or receiving condition and that operation of the push-to-talk button on an associated carbon microphone (or of a switch on an associated control box) disables the receiver and turns on the transmitter. Thus, conversation can proceed in only one direction at a time.

d. Arrangements are provided to permit the receiver-transmitter to be used as part of a relay, a repeater, or a retransmission station. The three terms, relay, repeater, and retransmission station, are used synonymously to signify an installation in which the audio output of the receiver or the receiver portion of a receiver-transmitter is linked to the audio input of another transmitter for the purpose of retransmitting a message. The technical characteristics of the receiver-transmitters are such that it is also possible to use them in a radio link to extend wire circuits such as telephone, telegraph, or facsimile circuits over terrain which makes the laying of telephone wires impossible or impracticable.

e. Provisions are included for the transmission of a ringing or call tone for the purpose of notifying the operator at the receiving end of an incoming message. This is used when the radio is part of a wire-radio circuit using this type of ringing. The ringing or call tone is analogous to similar provisions in conventional telephone communication.

f. Control of transmission and reception may be accomplished from the panel directly or by means of suitable control boxes from various local positions. Alternatively, remote control of these equipment functions is possible. Ringing through the transmitter and receiver-transmitter tuning are panel-controlled only. In some installations, provisions are made for adjustment of volume from the control position.

g. Since the receiver-transmitter is essentially a receiver circuit and a transmitter circuit in a common box without a power supply, microphone, headset, handset, antenna, suitable connectors, mountings, and hardware, these accessory components and materials are required to place the equipment in operation. These components and suitable control boxes are supplied separately as required for a particular system installation in which the receiver-transmitter is to be used. A detailed listing of the additional components required to place the receiver-transmitter into operation is given in paragraph 8. The manner in which the receiver-transmitter and the additional components are associated with each other to form a working installation is described briefly for the simplest case in paragraph 4. Detailed discussions of various types of installation arrangements in which the receiver-transmitter may be used are given in the technical manuals for the particular systems.

4. System Application

a. GENERAL. To use Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC, in operating installations, it is necessary to provide a source of transmitter modulation, audio receiving devices, a suitable source of operating power, and an antenna. In addition, suitable control, mounting, and connecting facilities must be provided.

(1) The source of audio power for transmission may be a microphone, the mouthpiece of a handset, a telephone line, or the audio output circuits of an interphone system or of another radio receiver.

(2) The audio receiving device may be a headset, the earpiece of a handset, a loudspeaker, a telephone line, or the audio input circuits of another transmitter or of an interphone system.

(3) The operating power source may be a vibrator-type power supply which derives its operating power from the vehicular storage battery. Specifically, either Power Supply PP–109/GR or Power Supply PP–112/GR may be used, depending on whether a 12- or 24-volt storage battery is involved. Alternatively, a combination of dry batteries (Case CY–590/GRC) and hand Generator G–8/GRC may be used to supply the necessary operating potentials (par. 5).

(4) The control arrangement used depends on the services required of the particular system installation in which the receiver-transmitter is used. Thus, a system may require direct panel control, control from a local position, or control from a remote position. In more complex systems, the control arrangement may involve the selection of operation functions such as duplex channel operation, message retransmission, or the

selection of one or more transmission paths if several equipments are involved. The function of changing the set over from the receiving to the transmitting condition is common to all such arrangements. This function may be performed manually, or the received signal may perform the function automatically. In the case of simple panel control, the microphone push-to-talk button provides this function. The more complex control arrangements are essentially extensions of the push-to-talk function through the circuits of components intervening between the operator's push-to-talk button and the control circuits of the receiver-transmitter.

b. Basic Arrangement. Figure 3 shows the manner in which the receiver-transmitter may be associated with a minimum of components to provide a workable system. The antenna, handset, and power supply are connected by suitable cables to the panel connectors of the receiver-transmitter. The point illustrated is that one receiver-transmitter can be used to establish a simple push-to-talk installation under control of the handset push-to-talk button. A set of relays within the receiver-transmitter connects power and the antenna so that either the transmitter is on and the receiver is off or the receiver is on and the transmitter is off.

c. References. The major components which are normally associated with Receiver-Transmitters RT–66/GRC, RT–67–GRC, and RT–68/GRC are described in separate technical manuals. The manner in which the receiver-transmitters are used as part of a complete installation in a communication network is described in separate technical manuals.

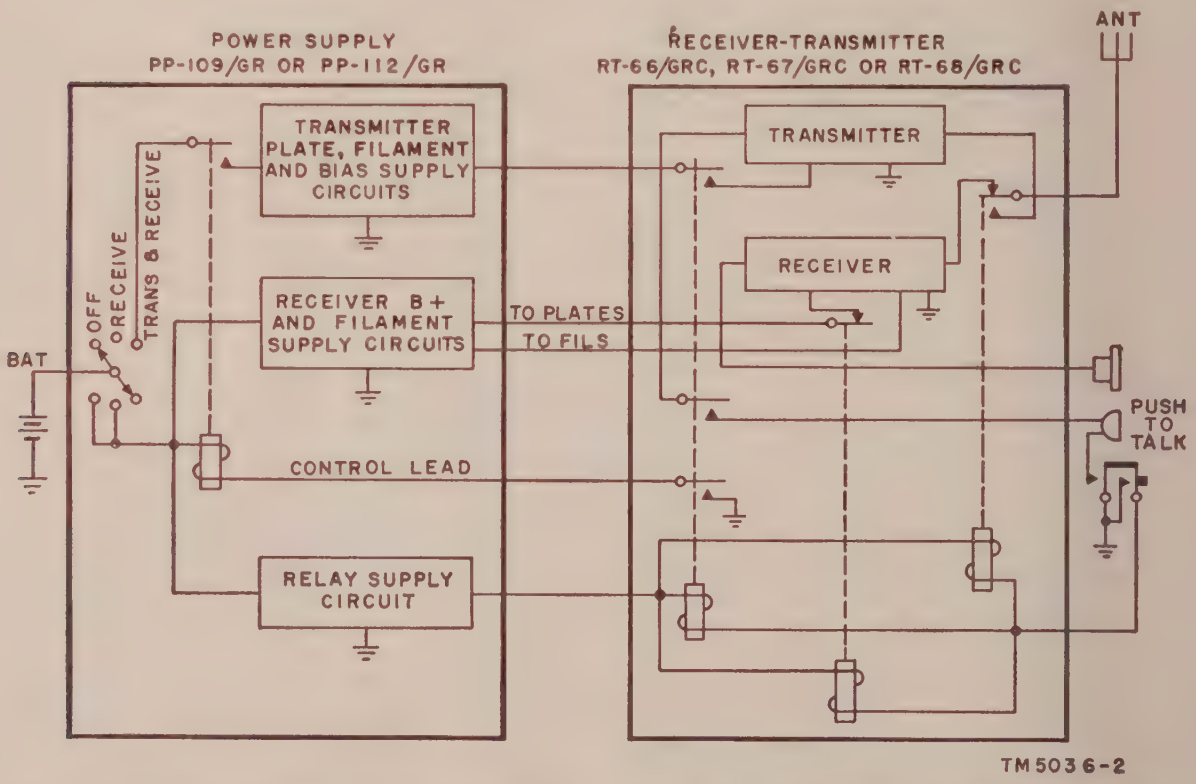

Figure 3. Application of Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC to Radio Sets AN/VRC–8, AN/VRC–9, and AN/VRC–10, simplified block diagram.

5. Technical Characteristics

a. Over-All Equipment.

Frequency range detented or tunable:
- Receiver-Transmitter RT–66/GRC ..... 20 through 27.9 mc.
- Receiver-Transmitter RT–67/GRC ..... 27 through 38.9 mc.
- Receiver-Transmitter RT–68/GRC ..... 38 through 54.9 mc.

Type of signals transmitted and received ..... Voice and 1,600–cycle ringing fm.

Type of tuning ..... Choice of detent or preset channels or continuous tuning.

Number of detent channels available:
- Receiver-Transmitter RT–66/GRC ..... 80.
- Receiver-Transmitter RT–67/GRC ..... 120.
- Receiver-Transmitter RT–68/GRC ..... 170.

Number of preset detented channels ..... 2.

Channel spacing ..... 100 kc.

Communication range:
- Vehicles in motion ..... 10 miles, approximately.
- Stationary vehicles ..... 15 miles, approximately.

Antenna requirements ..... One whip antenna serves both the transmitter and receiver circuits.

Antenna circuit tuning ..... Transmitter antenna circuit tunable at 1-mc intervals for a particular antenna installation by means of the antenna tuning control. After adjustment, tuning is automatic for all channels. Receiver antenna circuit tuned at one frequency for use over frequency range.

Type of operation ..... Push-to-talk; transmitter normally off.

Power supply requirements ..... Vibrator-type Power Supply PP–109/GR or PP–112/GR for vehicular installations; dry batteries (Case CY–590/GRC) and/or hand Generator G–8/GRC for ground installations.

Voltage of storage battery in vehicular installations ..... 12 volts with Power Supply PP–109/GR or 24 volts with Power Supply PP–112/GR.

Input voltages:

	High power (*dc*)	*Low power* (*dc*)
Receiver filaments	6.3 volts (595 ma)	6.3 volts (595 ma)
Transmitter filaments	6.3 volts (1.415 amperes)	6.3 volts (1.415 amperes)
Relay control circuits	5.6 volts (431 ma)	5.6 volts (431 ma)
Receiver plates	85 volts (50.5 ma)	85 volts (50.5 ma)
	105 volts (20 ma)	105 volts (20 ma)
Transmitter plates	85 volts (70.7 ma)	90 volts (75 volts)
	100 volts (19 ma)	90 volts (17 ma)
	150 volts (37.5 ma)	90 volts (22.5 ma)

	High power (*dc*)	*Low power* (*dc*)
	250 volts (11.5 ma)	105 volts (4.8 ma)
	450 volts (75 ma)	200 volts (33.5 ma)
Transmitter bias	–27 volts (2 ma)	0 volt

b. TRANSMITTER CIRCUIT.

Power output ..... Choice of high or low power.
Low power ..... 2 watts.
High power ..... 16 watts.
Maximum modulation frequency deviation .. ±20 kc, approximately.
Type of transmitter circuit ..... Crystal-controlled oscillator and oscillator power amplifier.
Crystal frequencies ..... See table I.
Transmitter variable oscillator frequency ... 4.45 to 5.45 mc.
Type of operational control ..... Push-to-talk; transmitter normally in stand-by condition.
Transmitter input impedances ..... 150 ohms.
Transmitter audio input level ..... 25-volt rms (root means square).

c. RECEIVER CIRCUIT.

Type of receiver circuit ..... Double conversion superheterodyne.
First i.f. (intermediate frequency) ..... Variable between 4.45 and 5.45 mc.
Second i.f. ..... Fixed at 1.4 mc.
Harmonic generator frequency range ..... See table II.
Second mixer oscillator frequency range .... Variable between 3.05 and 4.05 mc.
Type of operational control ..... Receiver normally in stand-by and silenced by squelch action. Turned on by signals having a minimum level determined by the setting of the squelch control.

Receiver bandwidth:
6–db (decibel) down ..... 80 kc.
30–db down ..... 140 kc.
60–db down ..... 200 kc.

Receiver audio power output:
At loudspeaker terminals of AUDIO connector ..... 800 mw. (milliwatt) maximum.
At phones terminals of AUDIO connector .. 50 mw.
At retransmit terminals of REC–TR CONTROL connector ..... 30 mw.
Audio power output control ..... Continuously variable by means of panel-mounted VOLUME control.
Audio output impedance ..... 600 ohms.
Maximum sensitivity with squelch ..... 25 microvolt, approximately.
Squelch control ..... Continuously variable, panel-mounted control adjusts squelch sensitivity. OFF position of control disables squelch circuit.

d. AUXILIARY CIRCUITS.

Test facilities ..... Meter and test switch on front panel check transmitter power output filaments of all tubes, and 90-volt input. Receiver test connector on chassis permits checking key points in the circuit.

6. Description of Receiver-Transmitter

a. Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC are double-conversion type superheterodyne f-m receivers and f-m transmitters. They are designed for the reception and transmission of f-m voice signals within the tuning range of 20 through 54.9 mc. This range is divided among the three sets as shown in figure 2. Each set has detent channels at integral 100-kc points and two of these detent channels can be preset. In addition, the detent arrangement can be released for continuous tuning over the entire band.

b. A front view of a typical receiver-transmitter is shown in figure 1. The unit is a compact, lightweight panel and chassis assembly with an outer cover. All operating controls, cable connectors, and indicators are mounted on the front panel and are immediately accessible. The panel is recessed to prevent damage to controls from impact. The case is attached to the front panel by means of wing-type, spring preloaded Dzus fasteners to effect a watertight assembly. Channel rails are attached to the bottom of the case so that the unit can be secured to a suitable mounting used in a vehicular installation. The case may be removed by turning the Dzus fasteners on the front panel one-fourth turn and sliding the case off from the rear. The dimensions of the entire unit are approximately 9 inches high, 11¼ inches wide, and 13 inches deep. The weight of the complete unit is approximately 34 pounds.

c. Figures 4 through 7 show a typical panel and chassis assembly removed from the case. The receiver-transmitter consists of three separable subchassis (fig. 34), namely—a front panel, an r-f (radio-frequency) chassis and an i-f chassis. The r-f chassis mounts the h-f (high-frequency) parts of both the transmitting and receiving circuits. The receiver i-f components and the audio components of both the transmitter and receiver are mounted on the i-f chassis. Both chassis are attached to projections at the rear of the front panel by means of screws and are so arranged that all internal tuning adjustment controls, tubes, and plug-in parts are accessible without disassembly of the unit. No solder connections are made between the r-f and i-f chassis or between these chassis and the front panel. Multiconnectors establish continuity between the chassis and the panel controls and connectors. Two side plates and a back plate add to the rigidity of the assembly. By removing the screws, the back plate, and the side plates and disconnecting the multiconnectors and shaft couplings, either one or both chassis may be removed for maintenance purposes. An important feature of the assembly is that a complete chassis can be substituted if either the r-f or i-f chassis of the set is defective. In addition, note that the i-f chassis of the three sets are identical, and with proper realinement are completely interchangeable. The panels of the three sets, minus the drive assembly, are also interchangeable. Markings and drive assembly are different for each set. The three sets differ only in the frequency-determining and selecting components.

(1) The cast-aluminum front panel (figs. 1, 12, and 35) mounts all operating controls and connectors, a meter with a METER switch, the tuning assembly drive, and the flexible couplings for the receiver and transmitter antenna tuning capacitors and for the transmitter antenna coupling unit. Flexible couplings connect the adjustment controls on the front panel to the receiver antenna capacitor and to the transmitter antenna coupling on the r-f chassis. The drive assembly, mounted on the rear of the front panel (fig. 35), couples mechanically to the drive mechanism mounted on both the r-f and i-f chassis for tuning the r-f circuits and variable i-f circuits, respectively.

(2) The r-f chassis of the three receiver-transmitters are similar in structure and component arrangement. There are some differences, however, mainly in the inductances of the tuning coils and in the number of frequency-determining crystals required. Thus, these chassis are not interchangeable from one set to another. Figure 5 shows the component side of the r-f chassis. Also refer to figures 36, 37, and 38. The r-f chassis mounts the h-f components of both the receiver and the transmitter, the crystal oscillator-harmonic generator circuit components, including tuning capacitors, crystals, the crystal switch assembly, and associated parts. The worm gear assembly (fig. 5) is connected by means of a flexible coupling to the receiver antenna tuning control, marked REC ANT TUNE on the panel. The cam assembly is actuated by the main dial drive assembly to tune the transmitter antenna capacitor (TR ANT TUNE) as the dial assembly is rotated.

This and other details of the dial drive mechanism and its functions are described in paragraph 13. The multiconnectors, J–4 and J–5 (fig. 36), are for connection to the front panel circuits. Toothed crown couplings on the shafts of the variable gang

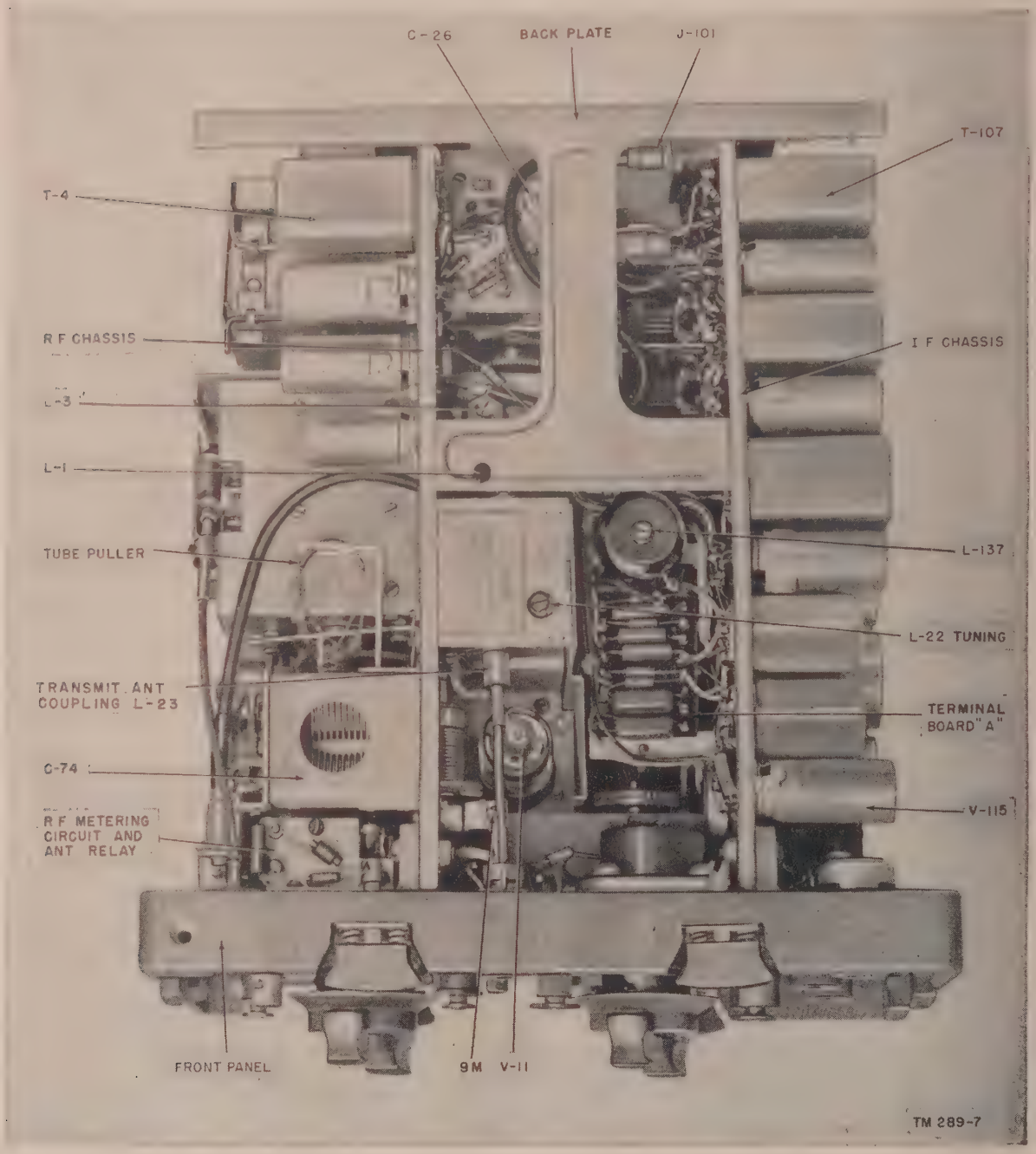

Figure 4. Typical receiver-transmitter, case removed, top view of panel and chassis assembly.

capacitors are arranged to mate and interlock with corresponding couplings on the dial drive mechanism on the front panel. These couplings are keyed to coordinate dial and variable capacitor settings.

(3) The i-f chassis (figs. 6 and 39 through 42)

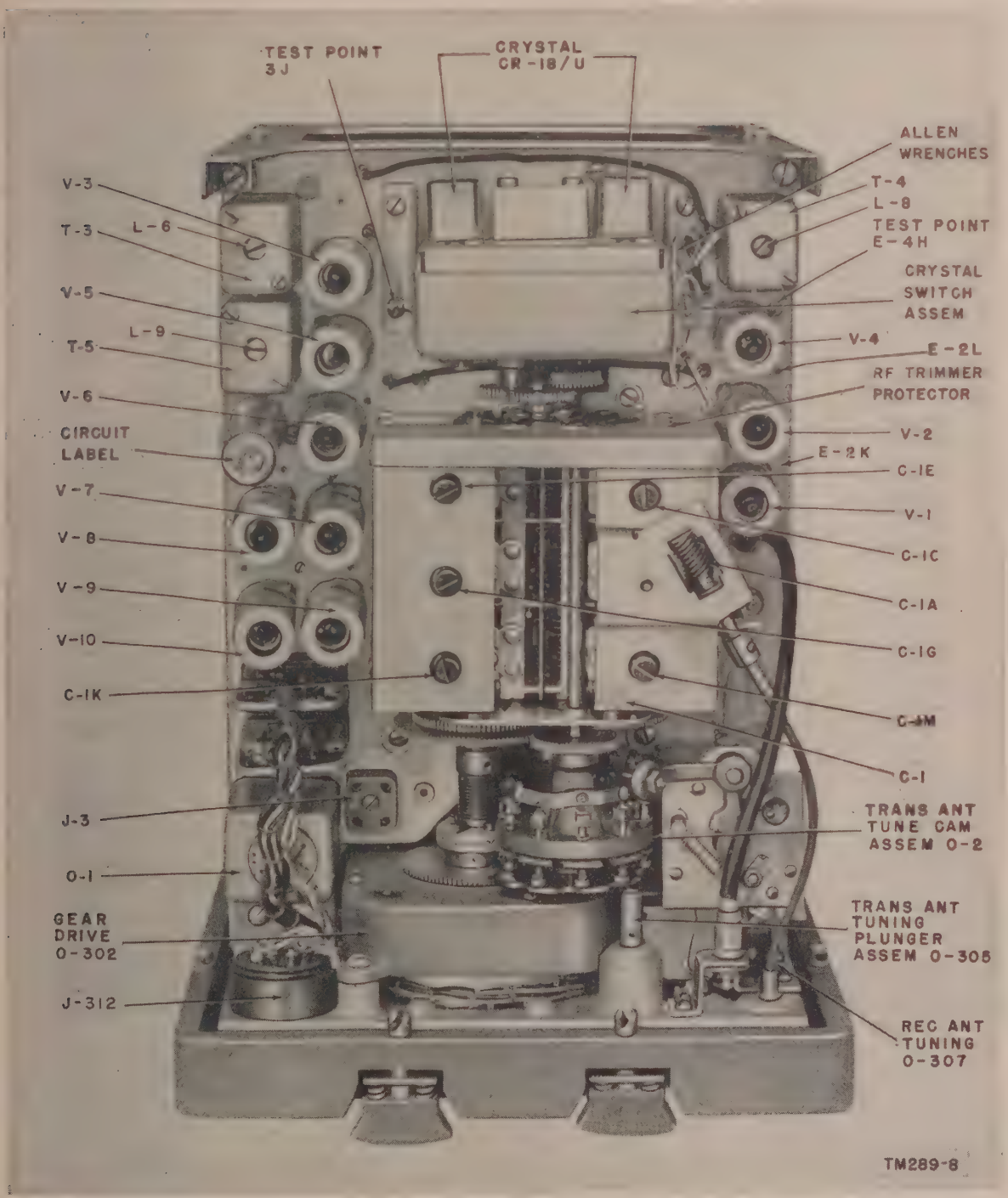

Figure 5. Typical receiver-transmitter, case removed, view of r-f chassis (left side of panel and chassis assembly).

mounts the components of the variable and fixed receiver i-f amplifier circuits, the receiver and transmitter l-f (low-frequency) oscillators, the transmitter reactance modulator, and the receiver and transmitter audio circuits. One of three control relays is also

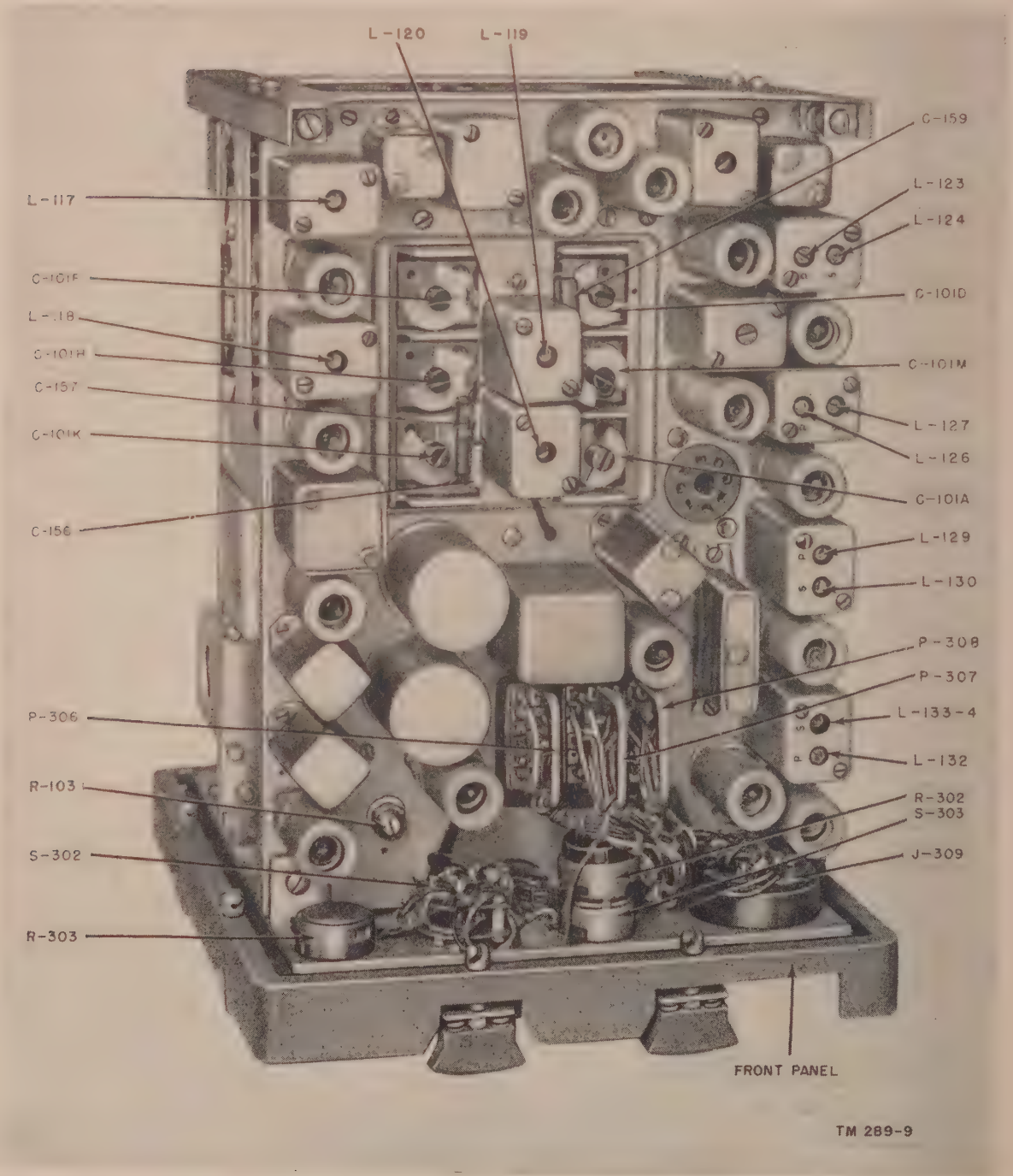

Figure 6. Typical receiver-transmitter, case removed, view of i-f chassis (right side of panel and chassis assembly).

mounted on this chassis (fig. 39). The i-f chassis is so arranged that it is suitable for use without change, except realinement, in any one of the three receiver-transmitters described in this book. A crown coupling (fig. 40) on the variable i-f gang capacitor

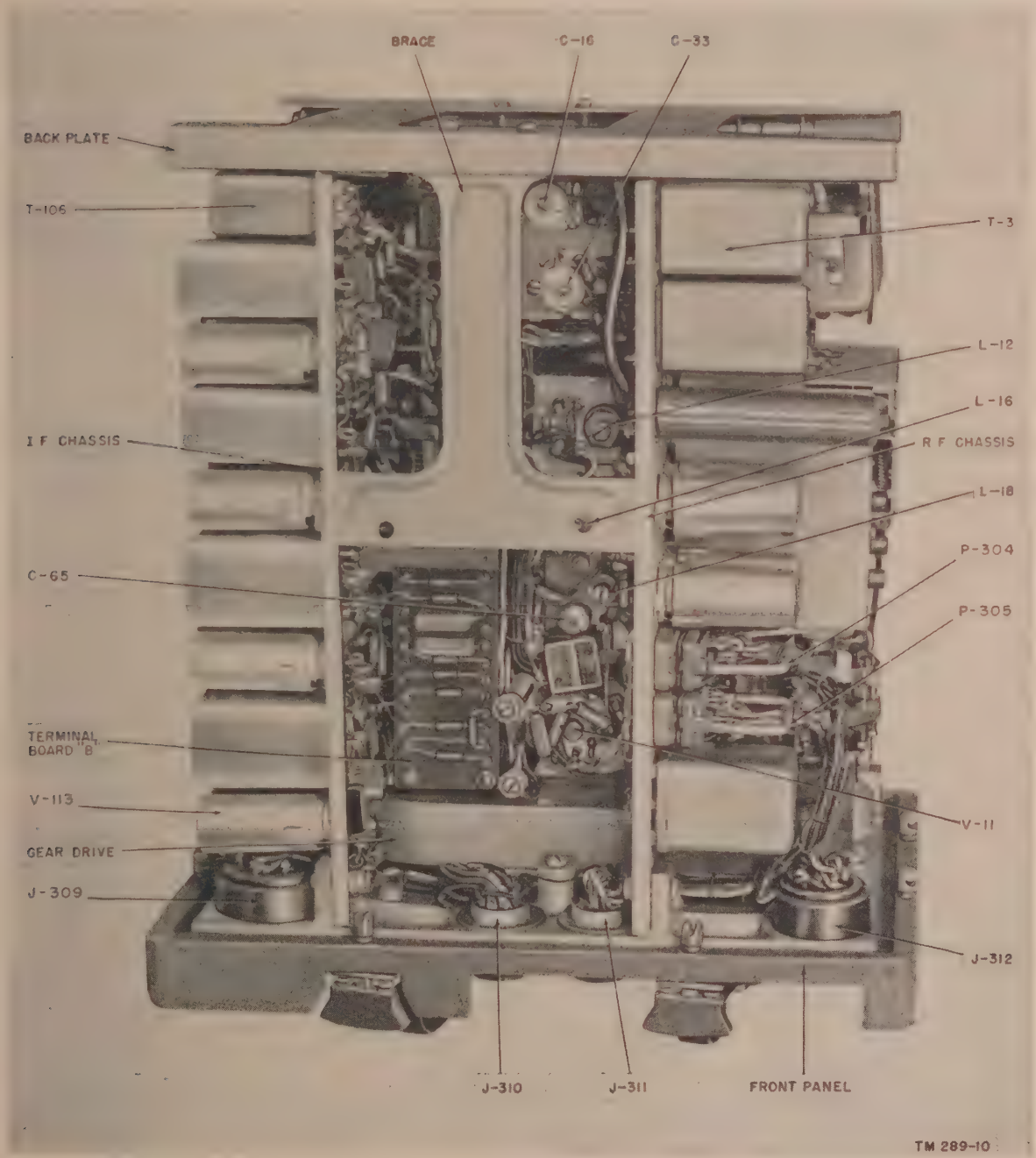

Figure 7. Typical receiver-transmitter, case removed, bottom view of panel and chassis assembly.

engages a corresponding coupling on the dial drive mechanism in a manner similar to that described in (2) above.

d. The r-f and i-f tuning capacitors are directly driven from shafts which extend out of the front panel planetary gearbox assembly (fig. 11). The harmonic amplifier tuning capacitor and the crystal switch are driven from the gearbox by additional gears at the rear of the set.

7. Controls, Instruments, and Connectors

(fig. 8)

All operating controls, built-in test instruments, and external connectors appear on the front panel of the receiver-transmitter. The following chart lists the controls, instruments, and connectors and indicates their functions. Note that the chart and figure 8 apply equally to all three receiver-transmitters.

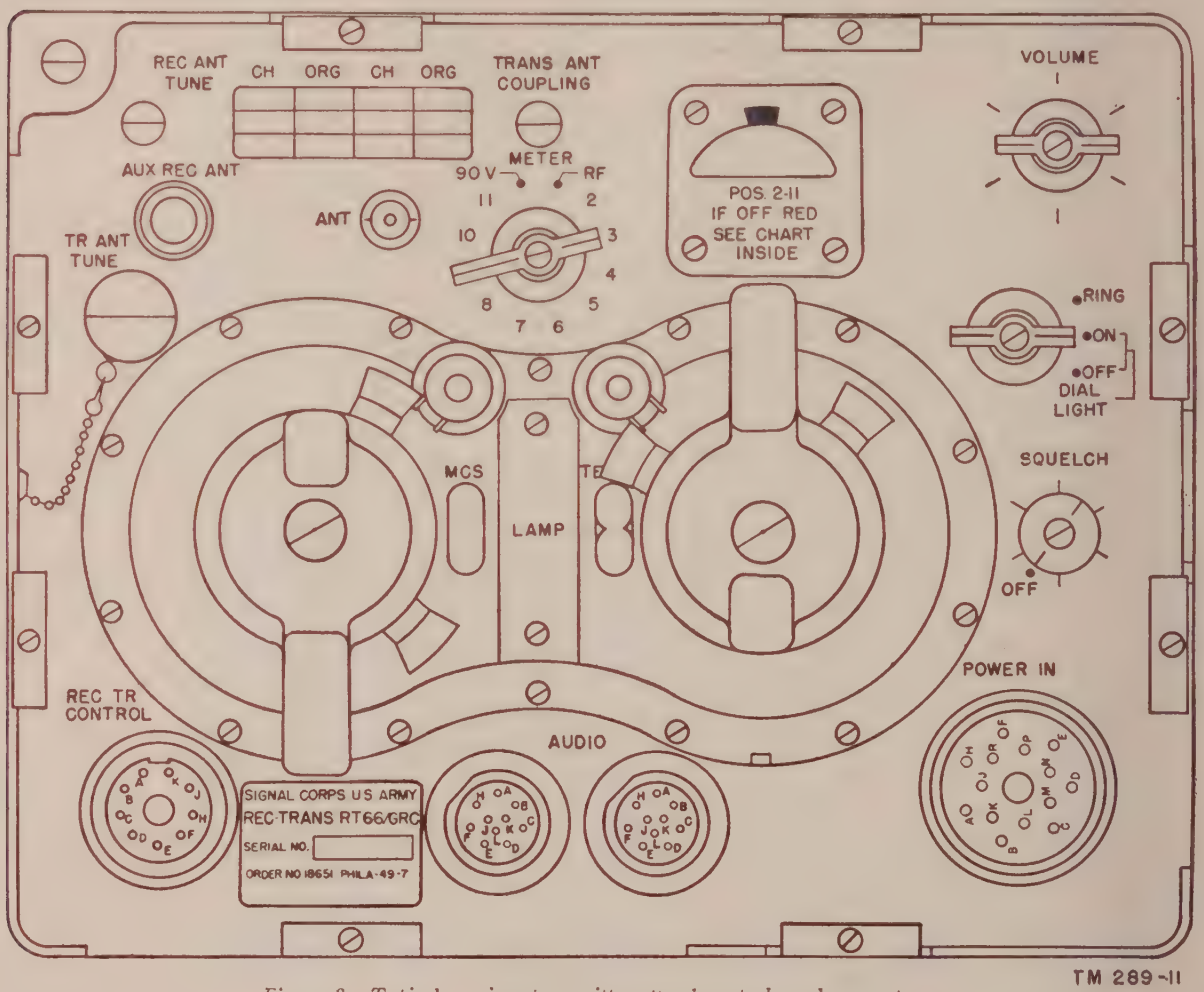

Figure 8. Typical receiver-transmitter, panel controls and connectors.

Control	Function
VOLUME (R–303)	Adjusts the receiver phone and high level audio output appearing at the AUDIO connector.
SQUELCH (R–302 and S–303).	Adjust the degree of the receiver squelch or noise quieting. In the maximum counterclockwise direction of rotation of the knob, the switch is turned off and the squelch or receiver noise quieting circuit is disabled, providing no receiver quieting. In the clockwise direction of rotation, increasingly stronger signals are required to disable the squelch and to restore the receiver audio amplifier circuits to normal operation. For any setting of the potentiometer, a particular signal-plus-noise-to-noise ratio is determined below which the receiver audio output is inoperative.
DIAL LIGHT (OFF-ON)-RING switch (S302).	A three-position switch which is spring loaded in the RING position. *Position* — *Function* OFF — Turns off dial illuminating lamp on the front panel and completes the microphone input circuit. ON — Turns on dial light and completes the microphone input circuit. RING — Breaks the microphone input circuit. Turns on a built-in ringing oscillator and energizes the transmitter to initiate the transmission of the ringing signal. Turns on dial light.
METER switch (S–301).	This 12-position switch connects the panel-mounted meter and associated circuits to various test points in the receiver-transmitter as follows: *Position* — *Function* RF — Connects the meter for measuring r-f voltage at transmitter antenna. 2 through 11 — Connects the meter into one of several series-parallel arrangements of tube filaments to check tube filament continuity. 90V — Checks the 85-volt d-c (direct-current) supply.
Meter (M–301)	1-ma (milliampere), 100-microvolt meter is used in conjunction with the METER switch described above to provide an indication of transmitter power output, to check the tube filaments, and to check the 85-volt supply. The scale is not calibrated but marked for normal readings only.
MCS (megacycle) control.	Part of tuning mechanism which tunes the receiver-transmitter. A complete description is given in paragraph 13.
TENTH MCS (kilocycle) control.	Part of the tuning mechanism which tunes the receiver-transmitter. A complete description of the function and operation of this control is given in paragraph 13.
TR ANT TUNE (C–74).	An antenna trimmer capacitor adjusting assembly used to adjust the transmitter antenna circuit.
TRANS ANT COUPLING (L–23).	Adjusts the inductive coupling between the antenna circuit and the transmitter power amplifier circuit.
REC ANT TUNE control (C–1A).	A trimmer capacitor adjusting assembly used to line up the receiver antenna circuit.
ANT connector	A small, pin-type coaxial connector which routes the common transmitter and receiver antenna to contacts on the antenna switch-over relay in the set.
AUX REC ANT connector.	A binding post used to connect an auxiliary receiver, if used, with the antenna circuit of the receiver.
POWER IN connector.	A 14-pin multiconnector which serves to connect the external plate and screen bias filament and the relay voltages to the receiver-transmitter circuits.
AUDIO connectors.	Two 10-pin multiconnectors arranged in parallel to bring the receiver output and transmitter audio input circuits to the front panel for connection to external equipments such as the handset, the microphone and the loudspeaker.
Detent channel presetting levers.	Serve to preset one or two detent channels for quick selection of desired operating frequency.
REC-TR CONTROL connector (J–312).	A nine-pin multiconnector which serves to make connection between the control circuits in the receiver-transmitter and external components such as control boxes, junction boxes, etc., as required by a particular installation.

8. Additional Equipment Required

The following materials are not supplied as part of the receiver-transmitters but are required for their installation and operation: a microphone and headset or a handset with a push-to-talk button, a loudspeaker (optional), an antenna with mounting components and hardware, a source of plate screen filament and relay power, suitable control boxes, mounting facilities, connecting cables, and a set of spare parts. The number and type of components necessary to complete a working installation differ from one installation to another depending on the complexity of the system. The materials normally supplied for a typical installation of Radio Set AN/VRC–8 are given below:

a. Receiver-Transmitter RT–66/GRC.

b. Power Supply PP–109/GR or Power Supply PP–112/GR, depending on whether the vehicular storage battery voltage is 12 or 24 volts, respectively.

c. Equipment mount, Mounting MT–299/GR.

d. Vehicular antenna components, as follows:

(1) Mast Base AB–15/GR.
(2) Mast Section AB–116–A.
(3) Mast Section AB–117–A.
(4) Mast Section AB–118–A.

e. Interphone operation Control Boxes C–375/VRC, the number depending on the number of monitoring positions required.

f. Remote control equipment (optional), Control Group AN/GRA–6, as follows: Local Control C–434/GRC and Remote Control C–433/GRC. These units provide for remote control of the equipment over a distance of not more than 2 miles of telephone wire. Also included in the group are Handset H–33/PT, Bag CW–189/GR, and a set of dry batteries. If remote control of the equipment is not desired, this control group is not needed.

g. RF Cable Assembly CG–530/U (4 feet, 2 inches.

h. Special Purpose Cable Assembly CX–1211/U.

i. Connector and bond nut (Appleton Electric Co. Nos. 61007 and BL–50, or equal).

j. Case CY–684/GR.

k. Adapters UG–273/U and UG–306/U.

l. Bag CW–206/GR.

m. Technical manual TM 11–286.

n. Special Purpose Cable WM–46/U (10 feet).

o. A set of mounting hardware and other installation accessories are provided in the installation kit.

9. Spare Parts

The following running spare parts are supplied with each receiver-transmitter:

2 tubes, electron, type 1A3.
2 tubes, electron, type 1AE4.
2 tubes, electron, type 1L4.
4 tubes, electron, type 1R5.
1 tube, electron, type 1S5.
6 tubes, electron, type 1U4.
3 tubes, electron, type 2E24.
1 tube, electron, type 3A4.
5 tubes, electron, type 3A5.
2 tubes, electron, type 3B4.
6 tubes, electron, type 3Q4.
2 tubes, electron, type 6AK5.

10. Miscellaneous Accessory Equipment

The following materials and tools are supplied with each receiver-transmitter:

a. Allen wrenches No. 050 (#4), 116 (#6), 332 (#10), 564 (#8) (fig. 5).

b. Tube puller (fig. 4).

c. Shorting bar (fig. 36), E–74.

d. Circuit label (fig. 5).

CHAPTER 2

THEORY OF RECEIVER-TRANSMITTER

11. General

The signal path of a typical Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC is shown in figure 9. This block diagram applies equally to all three receiver-transmitters. Complete schematic diagrams of the equipments are shown in figures 53, 54, and 55. The block diagram shows that the equipment consists of a separate transmitter circuit and a separate receiver circuit. The two circuits use a common antenna, a crystal oscillator, a harmonic generator, a set of control relays, and a common tuning control arrangement. Normally, the receiver is operative while the transmitter is in a stand-by or inoperative condition. When the microphone button is closed or when a switch on a control unit associated with the equipment in a given installation is operated to the required position, the receiver is effectively turned off and the transmitter is turned on. This function is accomplished when the ground return to the relay circuits is completed. The function of the transmitter is to convert speech signals from an external microphone, an amplifier, a telephone line, or another suitable a-f (audio-frequency) source into an f-m carrier signal. This is accomplished by causing the a-f signals to shift the frequency of an r-f oscillator, the output of which is mixed with a fixed r-f frequency, to obtain the desired carrier frequency. The resultant modulated carrier frequency is transmitted over the air. The function of the receiver is to accept f-m carrier signals and to convert them into the originally transmitted audio signals. The frequency range of the receiver-transmitter depends on the particular set involved (fig. 2). The range of the receiver-transmitter is divided into a number of preset 100-kc channels. Optionally, continuously variable tuning may be used. In addition to the main receiver and transmitter circuits, auxiliary circuits are provided. These include a ringing oscillator for the purpose of transmitting a 1,600-cycle call signal. Test circuits are also included to permit rapid spot checking of key receiver and transmitter circuits. The frequency conversion process for both the transmitter and the receiver is discussed briefly in paragraph 12. Paragraph 13 discusses the tuning arrangement provided for selecting the desired operating frequency. Paragraph 14 describes the control circuits which are common to the transmitter and to the receiver. Paragraphs 15 through 18 constitute a discussion of the block diagrams of the transmitter, the receiver, the ringer, the test circuit, and the afc (automatic frequency controls). The remaining paragraphs of this chapter constitute a stage-by-stage analysis of the equipment circuits.

12. Transmitter Carrier Frequency and Receiver I-f Generation

(fig. 9)

As shown on the block diagram (fig. 9), three oscillators serve to produce the transmitting carrier frequencies and the two intermediate frequencies of the receiver. Two of these are continuously variable, and one is adjustable in 1-mc steps. The transmitter and receiver are tuned to the same frequency at all times. The tuning arrangement (par. 13) coordinates the tuning of these three oscillators with one another and with the signal paths.

Table I. Receiver-Transmitter Crystal Frequencies

Crystal position No.	Crystal frequencies (kc)		
	RT-66/GRC	RT-67/GRC	RT-68/GRC
1			8,387.500
2	7,775.000	7,516.666	8,637.500
3	8,275.000	7,850.000	8,887.500
4		8,183.333	6,091.666
5	8,775.000	8,516.666	6,258.333
6		8,850.000	6,425.000
7	6,183.333	6,887.500	6,591.666
8			6,758.333
9	6,516.666	7,137.500	6,925.000
10		7,387.000	7,091.666
11	6,850.000	7,637.500	6,258.333
12		7,887.500	7,425.000
13	7,183.333	8,137.500	7,591.666
14	7,516.666	8,387.500	7,758.333
15			7,925.000
16			8,091.666
17			8,258.333

Note. Crystal position number increases in clockwise rotation of S-1.

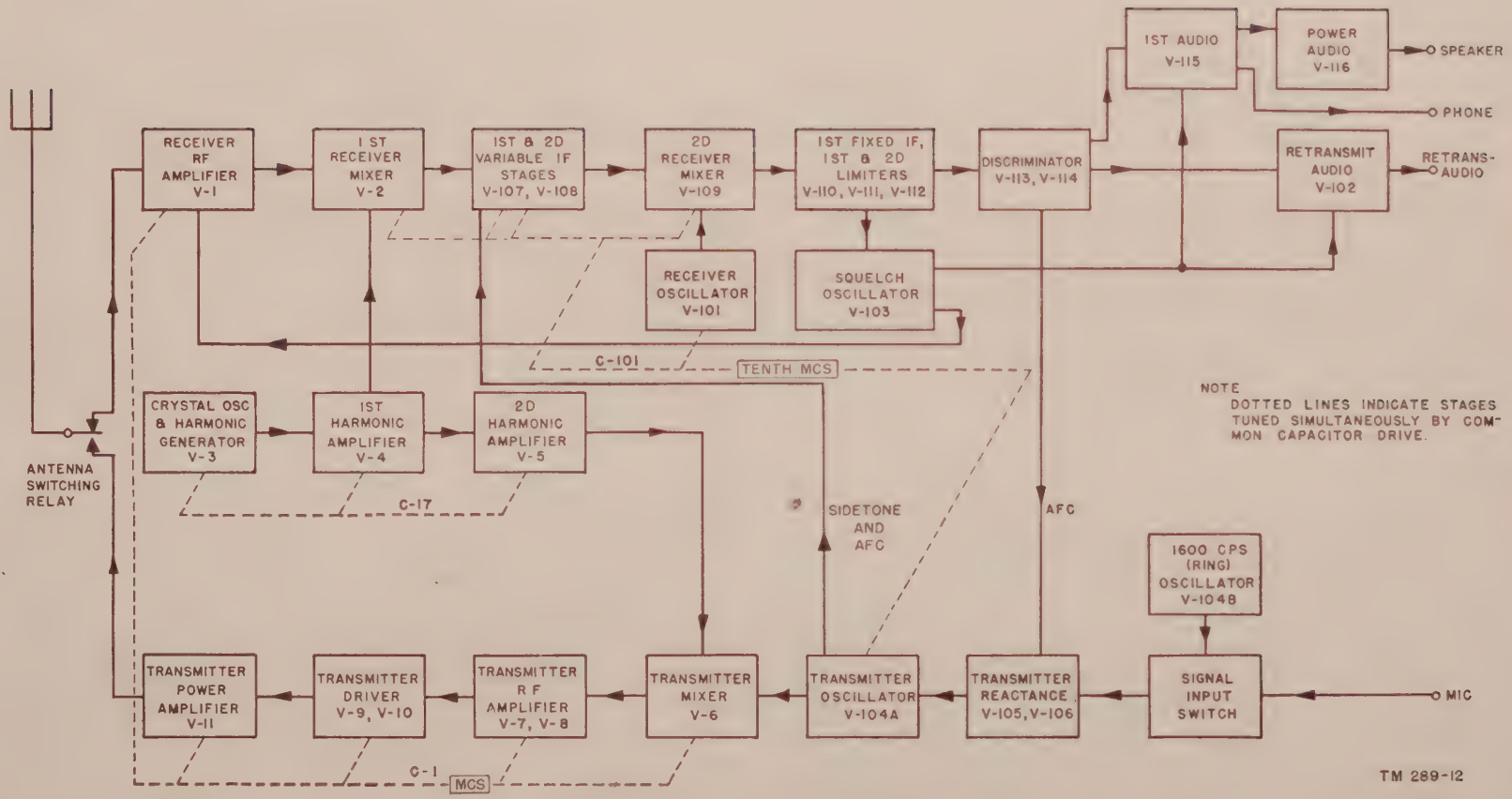

Figure 9. Typical receiver-transmitter, block diagram

a. Crystal Oscillator-Harmonic Generator and Harmonic Amplifiers V–3 through V–5. The common crystal oscillator-harmonic generator and first harmonic amplifiers V–3 through V–4 serve, in conjunction with the received signal, to provide the variable first i.f., between 4.45 and 5.45 mc. They also serve with the second harmonic amplifier and in conjunction with the variable transmitter oscillator, V–104, to provide the transmitting carrier frequency. Crystal oscillator V–3 is tunable in 1-mc steps by the selection of crystals. Table I shows the crystal frequencies used in each of the three receiver-transmitters. The frequency generated by the crystal oscillator remains fixed for each group of 10 adjacent channels. The output of the crystal oscillator-harmonic generator, V–3, is fed to the first harmonic amplifier circuit, V–4. The harmonic amplifier is tuned by a section of capacitor C–17 to select that harmonic of the crystal oscillator output which is below the nominal receiver-transmitter frequency by the amount of the variable i.f., that is, by a frequency within the band of 4.45 and 5.45 mc. The output of the first harmonic amplifier, V–4, is fed over one path to receiver mixer V–2, where, during reception of a signal, the variable first i.f. (between 4.45 and 5.45 mc) is produced. Another path applies the output to the second harmonic amplifier, V–5, where it is amplified except for part of the band in Receiver-Transmitter RT–68/GRC where the stage acts as a doubler. The output of V–5 is applied to the transmitter mixer V–6, where, during transmission, it is combined with the output of transmitter oscillator V–104A to produce the desired transmission frequency. First harmonic amplifier frequencies are given in table II.

b. Transmitter Oscillator V–104A. The variable transmitter oscillator, V–104A, serves in conjunction with the crystal oscillator-harmonic generator (subpar. a above) to provide the transmitter carrier frequency. It is tunable over a range of frequencies between 4.45 and 5.45 mc by section C of variable capacitor C–101. For any setting of this capacitor, the transmittor reactance modulator (V–105 and V–106) shifts the frequency of transmitter oscillator V–104A at the rate of the speech signals from the microphone. The f-m output of transmitter oscillator V–104A is applied to transmitter mixer V–6 where, together with the output of the second harmonic amplifier, V–5, the transmission frequency is produced. The tuning adjustment of capacitor C–101C is coordinated, through the tuning mechanism, with the tuning of the crystal oscillator-harmonic generator, V–3, so that the sum of the frequencies produced by these two oscillators is equal to the desired transmission frequency. To have the frequency of transmission and reception the same, the transmitter oscillator is placed under the control of the receiver oscillator and discriminator circuits.

c. Receiver Oscillator V–101. Variable receiver oscillator V–101 is tuned, in either 100-kc steps or by continuous variation, over the frequency range between 3.05 and 4.05 mc by section B of variable capacitor C–101. The output of the oscillator is applied to the receiver second mixer stage, V–109, where, together with the signal output of the variable i.f. amplifier, it produces the receiver fixed i.f. of 1.4 mc.

Table II. First Harmonic Amplifier V 4 Frequencies

Receiver-transmitter	MCS control frequency (mc)	Output frequency (mc)	Crystal harmonic used
RT–66/GRC	20	15.55	2d
	21	16.55	2d
	22	17.55	2d
	23	18.55	3d
	24	19.55	3d
	25	20.55	3d
	26	21.55	3d
Common	27	22.55	3d
RT–67/GRC	28	23.55	3d
	29	24.55	3d
	30	25.55	3d
	31	26.55	3d
	32	27.55	4th
	33	28.55	4th
	34	29.55	4th
	35	30.55	4th
	36	31.55	4th
	37	32.55	4th
Common	38	33.55	4th
RT–68/GRC	39	34.55	4th
	40	35.55	4th
	41	36.55	6th
	42	37.55	6th
	43	38.55	6th
	44	39.55	6th
	45	40.55	6th
	46	41.55	6th
	47	42.55	6th
	48	43.55	6th
	49	44.55	6th
	50	45.55	6th
	51	46.55	6th
	52	47.55	6th
	53	48.55	6th
	54	49.55	6th

13. Tuning Arrangement
(figs. 10, 11, and 12)

a. General. The receiver- transmitter is tuned to the desired operating frequency by means of two tuning controls, MCS and TENTH MCS, on the front panel (fig. 1). These controls, associated with each other through a gear drive mechanism mounted on the back of the panel, operate on the decade principle to tune the receiver-transmitter in either 1-mc or 100-kc steps or by continuous variation. The left-hand MCS control tunes the set in 10-channel (1-mc) steps. The dial associated with that control is calibrated in intervals of 1 mc (fig. 12) and the dial numbers read directly in mc. Within each mc range set up by the MCS control, the right-hand TENTH MCS control tunes the set either in steps of 100 kc, corresponding to an individual channel, or continuously. The dial associated with that control is numbered in tenths of an mc and has subdivision markings at 25-kc intervals (fig. 12). The frequency to which the set is tuned is obtained by taking the number shown in the MCS control window as an integer and the number shown in the TENTH MCS control as a tenths digit. Thus, with the MCS control set to 32 and the TENTH MCS control set to 9, the set is tuned to a frequency of 32.9 mc. The channel number to which the set is tuned is the frequency in mc multiplied by 10. In the above example, the channel number is 329.

b. Tuned Circuits. The tuning arrangement controls the settings of ganged capacitors, C–1, C–101, C–74, and C–17A, which, in turn, determine the frequency settings of the receiver-transmitter circuits as tabulated below.

Table III. Tuned Circuits

Adjustment item	Receiver-transmitter circuit controlled	Frequency range (mc)	Type of control
Capacitor C–1	Receiver r-f amplifier V–1 (T–2) Receiver-antenna circuit (T–1) Transmitter mixer V–6 (T–6) Transmitter r-f amplifiers V–7 and V–8 (T–7) Transmitter driver V–9 and V–10 (T–8) Transmitter power amplifier V–11	20 to 27.9 for RT–66/GRC or 27 to 38.9 for RT–67/GRC or 38 to 54.9 for RT–68/GRC	Continuously variable or variable in 1-mc or in 1.0-mc steps.
Capacitor C–17	Harmonic generator-harmonic amplifier V–3, V–4, and V–5 (T–3, T–4, and T–5)	15.55 to 22.45 for RT–66/GRC or 22.55 to 33.45 for RT–67/GRC or 33.55 to 49.45 for RT–68/GRC	Variable in 1.0-mc steps.
Capacitor C–101	Receiver oscillator V–101 (T–101) Receiver first mixer V–2 (T–107) Variable i-f amplifier V–107, V–108, and V–109 (T–108 and T–109) Transmitter oscillator V–103 (T–103)	3.05 to 4.05 4.45 to 5.45 4.45 to 5.45 4.45 to 5.45	Continuously variable or variable in .1-mc steps.
Capacitor C–74	Transmitter antenna tuning	20 to 27.9 for RT–66/GRC or 27 to 38.9 for RT–67/GRC or 38 to 54.9 for RT–68/GRC	Continuously variable.

c. Mechanical Coupling and Gearing Arrangement. The panel-mounted dial-drive assembly couples the MCS and TENTH MCS controls to each other, to the geared variable gang capacitor shafts, to the shaft of the crystal switch in the crystal assembly unit, and to the transmitter antenna tuning cam (figs. 10 and 11).

(1) Gears within the dial-drive mechanism couple the dial drives to three driving shafts which extend into the interior of the set. These shafts are joined in turn by toothed crown couplings and flexible shafts (bellows) to the shafts of variable gang capacitors C–1, C–17, and C–101.

(2) Each of the variable capacitor shafts is equipped with a set of gears. The gears

on the front ends of caacitors C–1 and C–101 are coupled through each other and to gears on capacitor C–17. Gears in the back of capacitors C–1 and C–101 are coupled through a rigid coupling to the shaft of crystal switch S–1 in the crystal assembly unit.

(3) The gear reduction ratio and the gearing arrangement (gears on the capacitors and within the dial drive mechanism) are such that every time the MCS control is rotated from one step to the next, the crystal switch shifts the number of steps required to introduce into the circuit the crystal associated with the particular dial frequency. In addition, the plates of capacitor C–17 are rotated by an amount which corresponds to a change of tuning by 1 mc. Capacitor C–101 is not rotated when the MCS control is turned.

(4) For every step of rotation of the TENTH MCS control, capacitor C–101 is rotated by an amount corresponding to .1 mc and capacitor C–1 is likewise rotated over an interval corresponding to .1 mc. The crystal switch and capacitor C–17 are not rotated when the TENTH MCS control is turned.

(5) The positioning of r-f tuning capacitor C–1 and of the transmitter antenna tuning cam depends on the settings of both the MCS and the TENTH MCS controls. Capacitor C–101 is rotated by the TENTH MCS control only. Capacitor C–17 and crystal switch S–1 are rotated by the MCS control only.

d. Continuously Variable Tuning. The gear-drive assembly is arranged so that by returning the TENTH MCS control to a stop at its extreme counterclockwise position, the detent mechanism may be removed and continuously variable tuning may be obtained. This arrangement permits the reception of signals at frequencies other than those on the detent channels. By turning the TENTH MCS control to its extreme clockwise position, the detent action may be restored.

e. Adjustment. The gear-drive assembly is a carefully designed assembly. It is not advisable to make any internal adjustments in the field. When difficulties with that mechanism are encountered, the whole unit should be replaced. By removing the knob and the dial plate cover on the front panel of the equipment, access is obtained to the detent screws (fig. 12) which may be adjusted to provide proper detent action. This applies to the TENTH MCS control only. The assembly is waterproofed by gasket covers, which screw on to the front panel, and by fittings on the control shaft.

f. Number of Detent Settings. The number of detent settings of the MCS dial for each of the three receiver-transmitters corresponds to the number of 1-mc intervals included in the frequency band covered by that receiver-transmitter, as follows:

Receiver - Transmitter RT–66/GRC–8 detent positions.

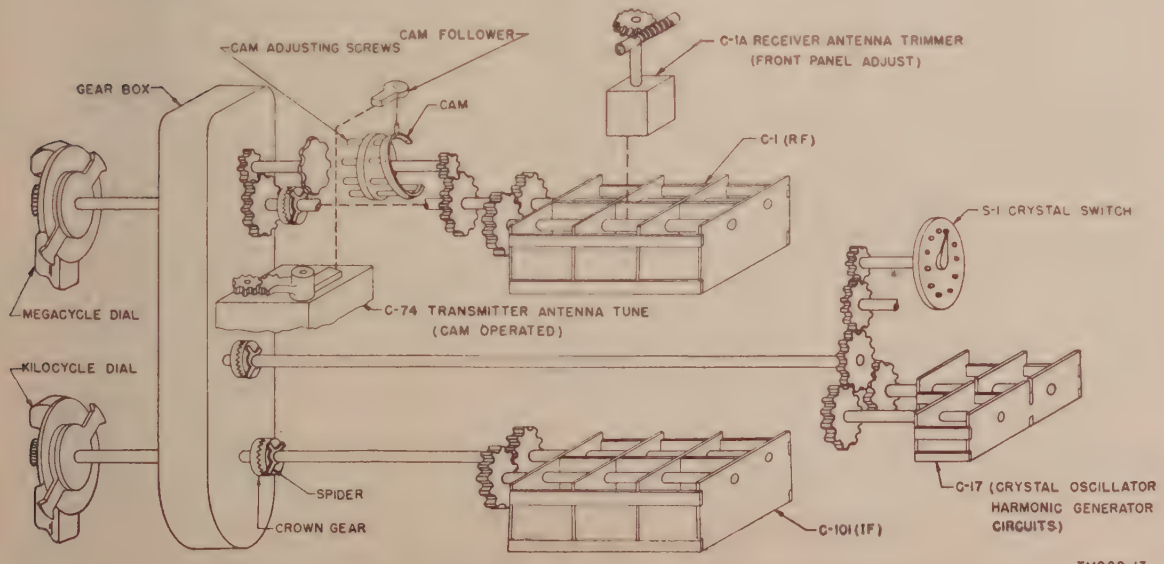

Figure 10. Typical receiver-transmitter, tuning arrangement, functional diagram.

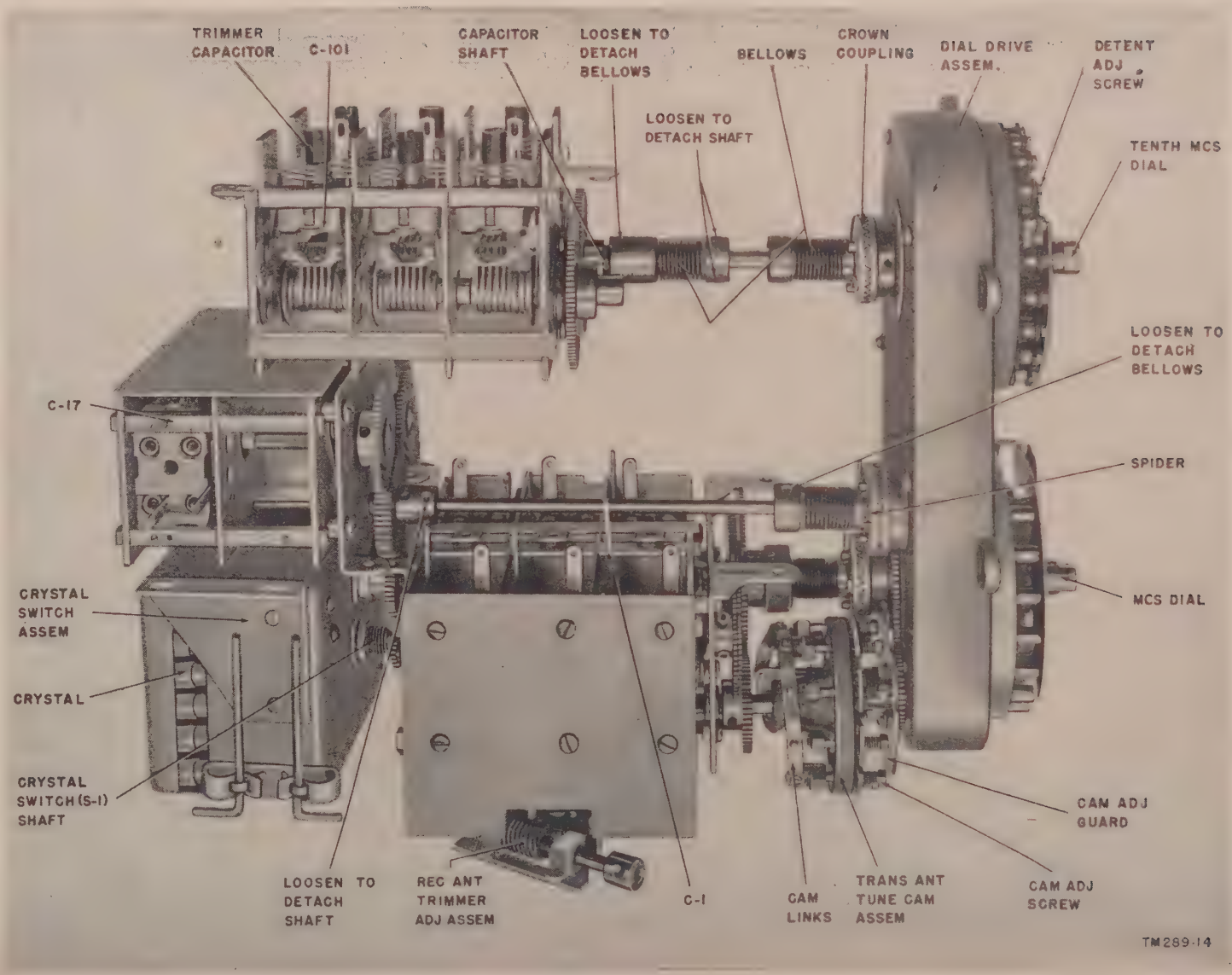

Figure 11. Tuning assembly, composite view.

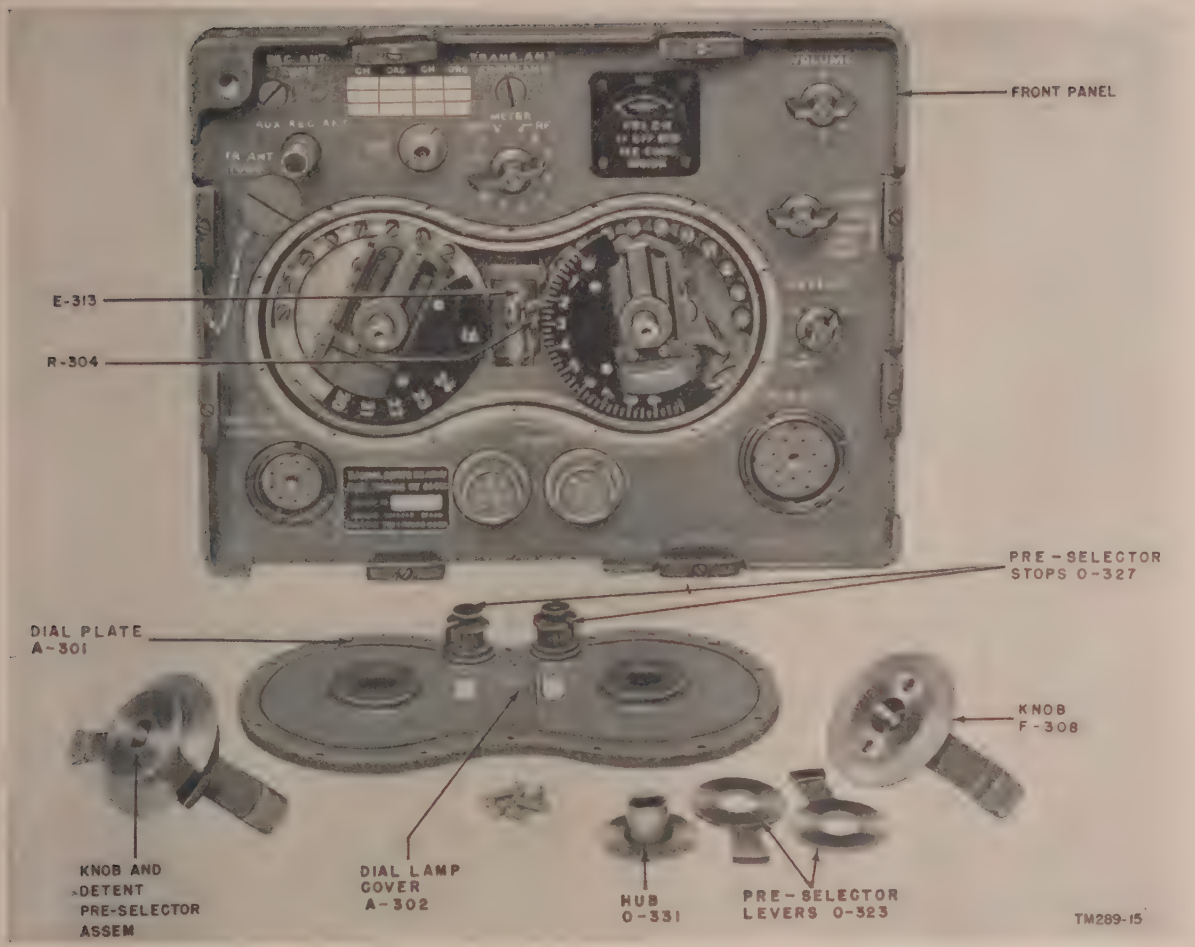

Figure 12. Front panel dial plate removed and preselector mechanism disassembled.

Receiver - Transmitter RT–67/GRC–12 detent positions.

Receiver - Transmitter RT–68/GRC–17 detent positions.

Except for the number of detent positions for the MCS control, the differential gears and the detent mechanism built into the gear-drive assembly is standardized for all three sets. However, the portion of the gear-drive assembly associated with the TENTH MCS control and the number of detent positions (10) for that control are the same for all three sets.

g. Preselection of Detented Channels. A preselecting mechanism (fig. 12) is associated with each of the two controls (MCS and TENTH MCS). Each consists of two levers, with serrated faces, which fit over the dial shaft and are held in place by the large screw holding the knob in place. Two stops are provided at the top of the dial cover plate. By slightly releasing the knob that holds the screw, the two levers can be set at any angle with respect to each other and with respect to the dial. One lever is painted green and the other red. When the dial is rotated and reaches the desired channel, the lever hits the stop and the dial comes to rest in the detent for which the lever was adjusted. The serrations on the levers prevent slippage. Thus the dial can be turned quickly to the desired preselected channel and stopped there. This arrangement is useful under operating conditions involving poor visibility or requiring speedy selection of either of two channels. The stop arrangement can be released and the dial permitted to rotate past the stop point by lifting and turning the stops.

h. Antenna Trimming Mechanism (figs. 10 and 11). The transmitter antenna tuning trimmer capacitor, C–74, requires a different setting for each

tuning adjustment of the set. The trimmer setting also depends on the antenna installation. Accordingly, a cam made up of a number of links (fig. 10) corresponding to the number of mc settings for the particular receiver-transmitter is associated with the tuning controls. As the MCS or TENTH MCS control is rotated, this cam rotates and imparts motion to a follower. The follower imparts motion to a gear drive which rotates the antenna tuning capacitor C–74. The curvature of the cam may be adjusted by a screw driver from the front panel TR ANT TUNE control. This control is covered by a waterproof cap which, when removed, exposes a wrench that is slotted for screw driver operation. This wrench (spring loaded) lines up with a cam-adjusting screw at each setting of the MCS control when the TENTH MCS control is at 0. In addition, there is an adjusting screw at the highest detent of each receiver-transmitter (27.9 mc, 38.9 mc, and 54.9 mc). By adjusting this screw, the amount of rotation of antenna trimming capacitor C–74 may be determined. In a given receiver-transmitter, this adjustment need be made only when the antenna is initially installed or when the antenna is changed, since the prime purpose of the arrangement is to insure proper matching between the antenna and the antenna output circuits. The adjustments are made for a maximum reading on the front panel r-f meter.

14. Receiver-Transmitter Control Circuits (fig. 3)

The function of energizing the transmitter and de-energizing the receiver, or vice versa, is accomplished by a control consisting of the parallel arrangement of three relays, O–1, O–301, and O–101. Normally, when the receiver-transmitter is in the stand-by or receiving condition, these relays are de-energized. When the operator closes the microphone push-to-talk button, or operates the DIAL LIGHT (ON-OFF)-RING switch on the front panel to RING, ground return to these relays is made, and the relays become energized with the following results:

a. The common antenna is switched from the receiver to the transmitter antenna circuits.

b. Filament power is applied to all transmitter stages.

c. Ground return is completed to the external power supply to energize that supply to provide the voltage required by the transmitter.

d. Plate, screen, and bias potentials are applied to the transmitter tubes and removed from the r-f stage of the receiver.

e. The input to the receiver audio circuits is switched to obtain sidetone level reduction.

15. Transmitter Circuits, Block Diagram (fig. 9)

The transmitter circuits include a microphone input transformer, T–106, a reactance modulator, V–105 and V–106, a transmitter oscillator, V–104A, the common crystal oscillator-harmonic generator, V–3, the transmitter harmonic amplifiers, V–4 and V–5, a mixer stage, V–6, and r-f stage, V–7 and V–8 in parallel, a driver stage, V–9 and V–10 in parallel, and the power amplifier stage, V–11, the transmitter antenna circuit, and the common receiver-transmitter antenna.

a. Transmitter Signal Path. Voice signals from an external source are applied through microphone transformer T–106 to the input of the transmitter reactance modulator. Under control of the audio signals, the reactance modulator causes the frequency generated by the transmitter oscillator (section A of V–104) to vary up or down in accordance with the amplitude and frequency of audio signals. Modulation is represented by a shift in the frequency generated by the transmitter oscillator and ultimately by a corresponding shift of the overall carrier frequency. The output of oscillator V–104A and the output of harmonic amplifier V–5 are combined in the transmitter mixer stage, V–6. A tuned circuit, using section F of tuning capacitor C–1, selects the desired sum frequency at the output of the transmitter mixer and applies it to the transmitter r-f amplifier stage, V–7 and V–8. The output of this stage is tuned to resonance at the carrier frequency by capacitor C–1, section H of the main r-f tuning capacitor. Further amplification is provided by transmitter driver stage V–9 and V–10 using section J of the r-f tuning capacitor, C–1, and then by the transmitter power amplifier stage, V–11. The amplified output is then routed through a tuned circuit to the antenna. The output circuit of the power amplifier uses section M of the main tuning capacitor, C–1, while the antenna circuit is tuned to resonance by the TR ANT TUNE capacitor, C–74.

b. Automatic Frequency Control. The purpose of the afc circuit is to maintain a constant transmitter oscillator carrier frequency. The output of the transmitter oscillator, V–104A, is picked up by

the variable i.f. stages in the receiver through stray coupling and fed to the rest of the receiver circuit. If the difference between the receiver oscillator frequency (used as the standard) and the transmitter oscillator frequency varies from the fixed i.f. frequency, a voltage is developed in the discriminator circuit. This voltage is used as the afc voltage and is fed to the transmitter reactance tubes, V–105 and V–106. The transmitter reactance stage then corrects the transmitter oscillator frequency. The time constant of the afc circuit from the discriminator is such that normal modulation of the i.f. does not appear in the afc voltage.

c. Sidetone. Sidetone voltage is obtained from the transmitter oscillator, V–104A. This voltage is picked up by the variable i-f stages through a stray coupling and fed through the rest of the receiver circuit to the AUDIO output connector.

d. Ringer Circuit. A ringer circuit, associated with the transmitter, is energized when the DIAL LIGHT (ON-OFF)-RING switch, S–302, is in the RING position. This switch has the same function for the ringing circuit as the push-to-talk button of the microphone has for the transmitter, since, in the RING position, that switch energizes the control relays. In addition, it applies power to the 1,600-cycle ringer oscillator, section B of tube V–104. The output of the ringer oscillator is applied to the microphone transformer, T–106. Signal transmission is accomplished as described in *a* above for any other audio signal.

16. Receiver Circuits, Block Diagram (fig. 9)

The receiver is of the double-conversion superheterodyne type arranged to receive f-m signals. The term double conversion means that the incoming carrier signal beats with one local oscillator frequency to produce a first i.f. (between 4.45 and 5.45 mc); this frequency in turn beats with another oscillator frequency to produce a second i.f. (in this case 1.4 mc). The discriminator demodulates the second i-f signal and the a-f section of the receiver amplifies the audio output of the discriminator. The amplified output is supplied to headphones, a loudspeaker, or other equipment.

a. Input Circuit. When the control relays are in their normal or unenergized position, the antenna is connected to the receiver circuits. Carrier signals from the antenna are developed in the antenna circuit, which is tuned by section B of the receiver-transmitter, r-f tuning capacitor, C–1. The signals selected are applied to the r-f amplifier stage, V–1, the output of which is tuned by section D of the receiver-transmitter, r-f tuning capacitor, C–1. The amplified output of this stage is routed to the receiver first mixer stage. With squelch operation, the gain of the r-f amplifier stage is controlled by the squelch circuit (par. 40).

b. First Mixer Stage V–2. This stage combines the output of the harmonic amplifier, V–4, with the amplified output of the first r-f amplifier stage, V–1, to produce the first i.f. in the range of 4.45 to 5.45 mc. The frequency produced depends on the setting of the TENTH MCS control (pars. 12 and 13). The crystal oscillator-harmonic generator and first harmonic amplifier serve both the transmitter and the receiver. Since the output frequency of the first harmonic amplifier is below that to which the receiver-transmitter is tuned by a frequency between 4.45 and 5.45 mc (depending on the setting of the tuning controls), the first i-f band resulting from the mixing of the incoming signal with the output of the first harmonic amplifier is a band centered about the difference frequency. The plate circuit of mixer stage V–2, located on the r-f chassis, is tuned by section E of the variable, i-f tuning capacitor, C–101.

c. Amplification of First i-f Signal. The difference frequency band at the output of the mixer stage, V–2, is amplified in the two-stage tuned, variable i-f amplifiers, V–107 and V–108. The variable i-f amplifier stages are tuned by sections G, J, and L of the variable, i-f tuning capacitor, C–101.

d. Receiver Oscillator V–101. The free-running, self-excited oscillator, V–101, generates a frequency between 3.05 and 4.05 mc depending on the setting of section B of the variable, i-f tuning capacitor, C–101. The frequency to which the oscillator is tuned is always 1.4 mc below that to which the variable i-f amplifier is tuned. Thus, if the variable i-f amplifier is tuned to 5 mc, the receiver oscillator is tuned to 5 minus 1.4, or 3.6, mc. The oscillator is temperature-compensated for high stability.

e. Receiver Second Mixer V–109. The output of the variable i-f amplifier, a frequency between 4.45 and 5.45 mc, together with the output of receiver oscillator V–101, is combined in the receiver second mixer, V–109. The frequency generated by the oscillator subtracts from the first (variable) i-f signals to produce a second i-f of 1.4 mc.

f. Fixed Second i-f Amplifier and Limiter. The i.f of 1.4 mc is again amplified by a three-stage, fixed tuned amplifier. The first stage, V–110, is a conventional i-f amplifier; the second and third stages, V–111 and V–112, are also designed to function as limiters to eliminate any amplitude variations of the signal. Such amplitude variations represent noise and are undesirable. Proper functioning of the discriminator, which follows the second limiter, requires that the level of the applied signal be fairly uniform for variations in the level of the incoming signal. A portion of the input to the first limiter is fed to the squelch circuit to provide silencing action, as described in *i* below and in paragraph 40.

g. Discriminator. The output of the final limiter stage, V–112, is applied to the discriminator, V–113 and V–114, through T–113. The discriminator is a tuned circuit using two type 1A3 diode tubes as rectifiers. The term discriminator is typical for f-m receivers and signifies a circuit which corresponds to the detector in a-m (amplitude-modulated) receivers. The discriminator performs a function analogous to that of the a-m detector in that it extracts the intelligence or audio modulation from the incoming carrier signal. Since, in frequency modulation, the intelligence to be detected appears as variations in frequency (that is, shifts of the carrier from a center frequency) instead of amplitude variations, the discriminator is a frequency sensitive, but not an amplitude sensitive, device. Thus the discriminator converts the variations from the center frequency of the incoming signal into audio signals.

h. Audio Amplification. The a-f signals that appear at the output of the discriminator are amplified in two separate audio amplifier circuits.

(1) One circuit is a two-stage audio amplifier, V–115 and V–116, with gain adjustable by means of the panel-mounted VOLUME control, R–303. The output of the first stage, V–115, is connected to pins A of each of the AUDIO connectors, J–310 and J–311, and to pin E of the REC-TR CONTROL connector, J–312, and is used to provide enough volume to operate a headphone or the earpiece of a handset. The output of the final audio power amplifier stage, V–116, is connected to pins L of each of the AUDIO connectors, J–310 and J–311, and to pins F and A of the REC-TR CONTROL, J–312, and has sufficient output to drive a loudspeaker.

(2) The other amplifier circuit, a one-stage amplifier, V–102, serves to provide an audio output level for use in systems applications. No panel adjustment of volume is provided. However, an internal potentiometer, R–103, provides screw driver adjustment of the gain of the amplifier for the required level. The output of this stage is connected to pin B of REC-TR CONTROL connector J–312.

i. Squelch Oscillator V–103. It is characteristic of very sensitive receivers that, in the absence of signal, a rushing noise is heard in the receiver phones or the loudspeaker. The noise is the result of thermal agitation in the vacuum tubes and receiver components and of external electrical disturbances. A squelch circuit is used to suppress this noise during no-signal intervals. In Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC, the squelch circuit consists of a carrier-switched, 20-kc (approximately) oscillator and a diode rectifier, V–103. Squelch action is adjustable by means of the panel-mounted SQUELCH control, R–302. The squelch circuit can be disabled for test purposes or for reception of very weak or fading signals by turning the SQUELCH control to the OFF position.

17. Test Circuits

A number of check points, to facilitate testing and alinement of the receiver-transmitter circuits, are described in the following paragraphs.

a. Meter and Test Switch. The 12-position, panel-mounted METER switch, S–301, connects the meter and arranges the meter circuits as required for determining the continuity of the filament circuit, the voltage at the 85-volt circuit, and the transmitter power output.

b. Receiver Test Socket X–200. Pins on octal socket X–200 on the i.f. chassis of the receiver-transmitter are connected to pertinent receiver test and adjustment points such as the discriminator output, the second limiter input, etc. Rapid spot checking at the test socket, X–200, of key receiver circuits for test and alinement purposes is made possible without disassembling the panel and chassis assembly.

c. E Test Points. Certain key circuits of the receiver and transmitter that are not picked up by test socket X–200 or by the METER switch, are wired to feedthrough and stand-off terminals within the set, permitting rapid measurement of signal voltages and levels at these points. The receiver first mixer

input and the input to the first harmonic amplifier and some of the transmitter r-f stages are examples of circuits picked up by E points (figs. 53 through 55). A 4-prong socket, J–3, on the r-f chassis (fig. 5) provides test points for the final stages of the transmitter.

18. Stage Analysis

Detailed descriptions of the stages of Receiver-Transmitter RT–68/GRC are given in paragraphs 19 through 43. These descriptions apply also to Receiver-Transmitters RT–66/GRC and RT–67/GRC. Paragraph 46 covers the differences among the three receiver-transmitters. Schematics for the three sets are given in figures 53, 54, and 55. The differences consist essentially in values of parts in the r-f, transmitter power amplifier and receiver squelch circuits, the use of damping resistors, neutralization in the tuned circuits of the r-f stages, and in the arrangement of the crystal oscillator-harmonic generator and harmonic amplifier.

19. Microphone Input Circuit
(fig. 13)

a. Three parallel input connections are provided for the carbon button of the microphone or some other source of audio modulation to be transmitted. One connection is at terminals C and D (ground) of REC-TR CONTROL connector J–312 and the other two at terminals C and E (ground) of each of the AUDIO connectors, J–311 and J–310. The microphone circuit extends through contacts 7 and 8 of the DIAL LIGHT (ON-OFF)-RING switch, S–302, and through chassis connectors P–306 and J–106 (terminals 12) to the 150-ohm primary winding (terminals 6–7) of microphone transformer T–106. The ground return path for the audio signals is completed through bypass capacitor C–144A. The output of the 1,600-cps (cycle-per-second) oscillator (par. 28) is fed to the other primary winding (terminals 4–5) of microphone transformer T–106.

b. D-c voltage for energizing the carbon button of the microphone is applied from an external 6.3-volt source to terminals N and D (ground) of POWER IN connector J–309. The microphone d-c supply circuit extends from terminal N of J–309, through terminals 13 of i-f chassis connectors P–306 and J–106, over the normally open contact pair 5–4 of control relay O–101 (par. 41), and through filter choke L–137 to terminal 7 of T–106. Choke L–137 and capacitors C–144A and C–301 serve to filter a-c ripple and vibrator hash from the power supply. Resistor R–130 and choke L–137 act as a voltage divider to provide the proper voltage to the microphone circuit.

c. Contacts 5–4 of relay O–101 (par. 41) close and apply microphone energizing voltage when the microphone push-to-talk button is closed, or when some other external circuit arrangement completes the ground return for the coil of relay O–101. The signal voltage developed across winding 6–7 or 4–5 of T–106 is induced into secondary winding 1–2–3 for application to the reactance modulator, V–105 and V–106 (par. 21).

20. Transmitter Oscillator V-104A
(fig. 13)

a. The self-excited 4.45– to 5.45–mc oscillator uses one section of the twin-triode tube type 3A5, V–104A, in a modified Hartley circuit. Plate coil L–109 and grid coil L–110 form the conventional Hartley inductive voltage-dividing circuit. The grid (pin 5) is coupled through capacitor C–129 to the oscillator tank circuit. R–114 establishes the d-c return path for the grid and provides self-bias for operation of the oscillator triode. Regenerative feedback from plate to grid, necessary to sustain oscillations, is provided by induction from plate coil L–109 to grid coil L–110.

b. The nominal or center frequency generated by the oscillator is determined by the tuning of the parallel resonant circuit, consisting of coils L–109 and L–110, capacitor C–101C (controlled by the TENTH MCS control), shunt and series padding capacitors C–124 and C–123, respectively, and trimmer capacitor C–101D. The padder capacitors serve to facilitate tracking of the oscillator with the tuned circuit of the receiver variable i-f amplifier. The center frequency is set during alinement by the adjustment of the variable trimmer capacitor, C–101D, and of the inductance of coils L–109 and L–110 while no audio signal is present in the circuit.

c. The tuned plate circuit of the oscillator is shunted by the series arangement of resistor R–115, blocking capacitor C–130, and coils L–112 and L–113 in parallel. The two coils are the primary windings of the powdered iron core transformer in T–104, which links the oscillator with the reactance modulator. For a particular setting of the i-f tuning capacitor, C–101 (selected during operation by means of

the TENTH MCS control), the frequency of oscillations is determined by the total instantaneous inductive reactance of the oscillator tank circuit. However, coils L–112 and L–113 contribute to the oscillator tuning. Paragraph 21 explains how coils L–112 and L–113 are made to affect the oscillator frequency in proportion to the a-f signal.

d. The series arrangement of capacitors C–125 and C–126 acts as a voltage divider across the resonant circuit of the oscillator. A portion of the oscillator output, taken at the junction of these two capacitors, is fed through interchassis coaxial connectors J–102 and P–2 for application to the transmitter mixer stage, V–6.

e. Plate voltage is fed from the external 85-volt supply through contacts 8–9 (normally open) of relay O–101, filter choke L–111, and plate coil L–109 to the plate (pin 6) of V–104A. Capacitors C–127 and C–128 bypass the d-c plate supply for r-f voltages. Refer to paragraph 44 for filament circuit arrangements.

f. Most of the components in the tuned circuit of the oscillator are inclosed. The assembly is identified on the schematic diagram as T–103. Included in the assembly are tuning coils L–109 and L–110, shunt padder C–124, voltage-divider capacitors C–125 and C–126, plate supply choke L–111, and bypass capacitor C–127. The iron slug for adjusting L–109 and L–110 is accessible through the cover of T–103.

21. Modulation

(fig. 13)

a. Frequency modulation causes the center or carrier frequency of the transmitter oscillator (par. 20) to be shifted in frequency in proportion to the amplitude of the audio signals to be transmitted. The amplitude variations of the audio signals become changes or deviations in the frequency of the carrier from center value, while the frequency of the audio signals becomes the rate with which the frequency of the carrier changes.

b. In the receiver-transmitter, the modulation process makes use of the fact that when a current flowing through a circuit leads or lags the voltage across it, the effect is the same as if a capacity or an inductance were connected across the circuit.

c. Two vacuum tubes, V–105 and V–106, each a tube type 1R5, are connected as a balanced reactance tube modulator (fig. 13). Two parallel primary windings, L–112 and L–113, of the iron core transformer in T–104 are connected across the plate tank circuit of the oscillator. These windings are self-resonant at about 2 mc. Since the oscillator frequencies are much higher than 2 mc, the oscillator current flowing through these coils sees a capacitive reactance and thus leads the oscillator tank voltage by 90°. The voltages developed by induction across the two halves of the secondary winding of the transformer are 180° out of phase with respect to each other, since the two windings are connected in a series-opposing relationship. The r-f voltages applied to the first grids (pins 4) of V–105 and V–106 are 180° out of phase with respect to each other, but equal in magnitude. With no audio signals applied to the second grids (pins 6) of V–105 and V–106, the transconductances of the tubes are set a certain design (initial condition) values. Therefore, the amplified plate voltage of the two tubes (resulting from the first grid voltages) is such that one leads the oscillator plate current by 90° while the other lags the current by 90°. Thus, the reactance tube plate currents flowing together through the oscillator tank circuit are equal in magnitude but opposite in direction, and the resultant reactive component is zero. The frequency generated by the oscillator is determined entirely by the values of capacity and inductance in the tank circuit, and is the center frequency selected by the tuning controls on the front panel.

d. Audio signals from microphone transformer T–105 are applied through the high a-f pre-emphasis network, C–145, C–142, C–137, and C–138, to the second grids (pins 6) of V–105 and V–106 180° out of phase with respect to each other. During one half-cycle excursion of the audio voltage, the transconductance of one tube is increased, while that of the other is decreased. The direction (or sense) of the change is reversed during the next half-cycle of the audio signal. The amount of change in the transconductance is proportional to the instantaneous amplitude of the applied audio signals. Since the leading current component of one tube is no longer equal to the lagging current component of the other tube, the combined plate currents of the two tubes have a resultant current either leading or lagging the oscillator voltage by less than 90°. Thus, in flowing through the oscillator plate tank circuit, the effect is as if a reactance (capacity or inductance) were placed across the resonant circuit. The tank circuit is detuned, and the frequency generated by the oscillator is varied proportionally.

e. The relationships between the plate currents from V–105 and V–106 and from the transmitter

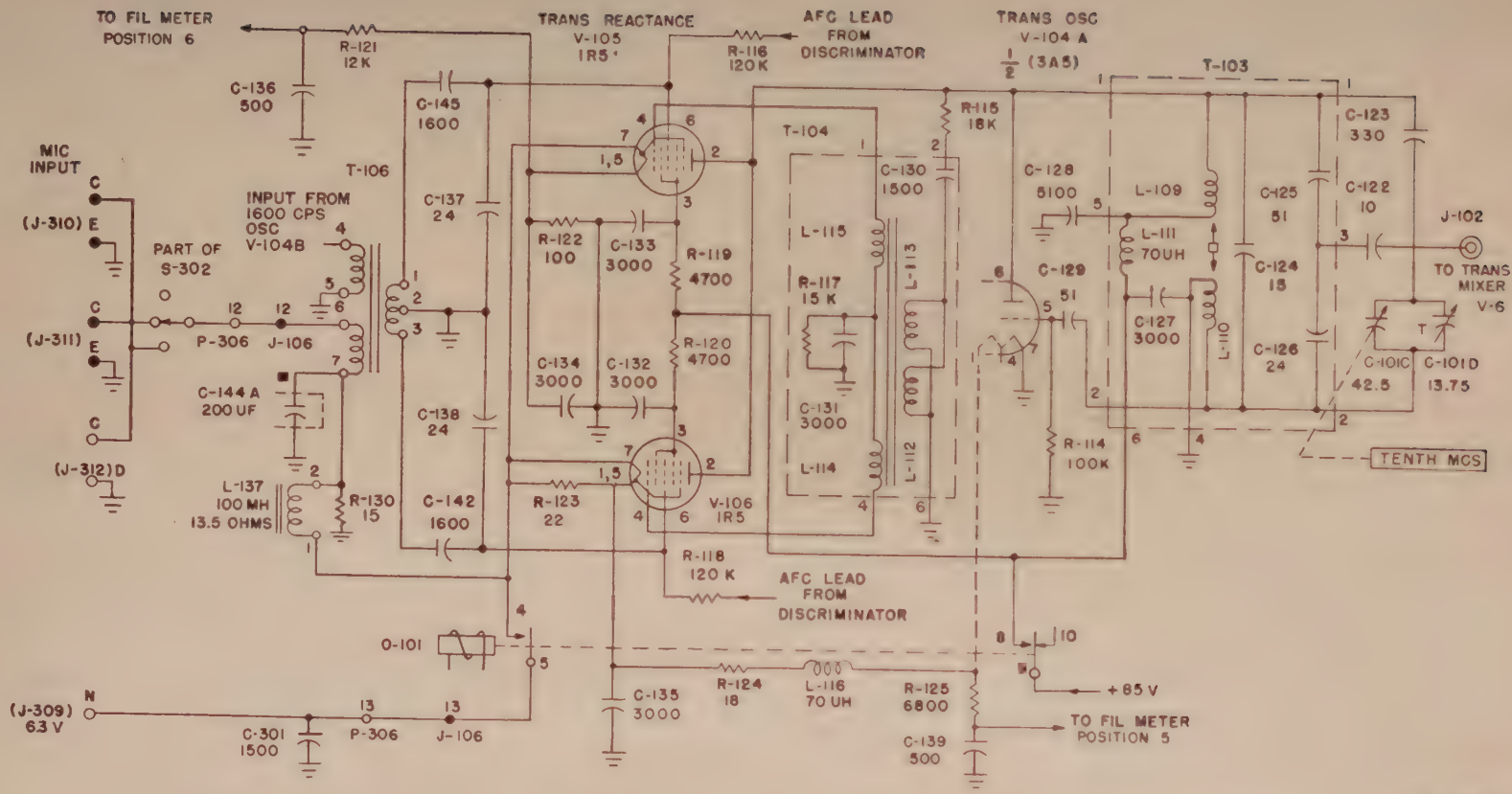

Figure 13. Receiver-transmitter, microphone circuit, reactance modulator, and transmitter oscillator, functional diagram.

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oscillator section, V–104A, when no audio signal is present are shown in vector diagram A of figure 14. The corresponding relationships between these plate currents during the two half-cycle excursions of the audio signal are shown in vector diagrams B and C of figure 14. In each diagram, lines OA, OB, and OC represent the currents from V–105, V–106, and the transmitter oscillator section of V–104A respectively. Lines OE represent the resultants obtained by vector subtraction of currents OA and OB. Lines OD represent the resultant output currents. Phase angles ⊙ represent the excursions of the resultants for particular audio signal amplitudes.

f. Plate voltage for the reactance modulator tubes is supplied through contacts 8 and 9 of relay O–101 (when energized) from the external 85-volt supply. The plate supply circuit includes filter choke L–111, bypass capacitor C–127, and the plate winding of the transmitter oscillator tuning coil, L–109. Screen voltage is supplied through voltage-dropping resistors R–119 and R–120, which are bypassed by capacitors C–133 and C–132, respectively. The first grids (pins 4) are returned to ground for dc through grid leak resistor R–117, which is bypassed for rf by grid leak capacitor C–131. Filament voltage is supplied over contacts 4 and 5 of relay O–101 (when energized). Filament voltage-dropping resistor R–122 and current limiting resistor R–123 are bypassed to ground for rf by capacitors C–134 and C–135, respectively.

g. The balanced arrangement of the modulator, with push-pull injection of the audio signal, serves to provide a greater frequency deviation for a given audio cycle excursion than is possible with a single-ended arrangement. This is because, during one half-cycle of the audio signal, one tube provides decreasing capacitance and the other increasing inductance. On the next half-cycle, capacitance increases and inductance decreases.

h. Resistors R–116 and R–118 are part of a filter in the afc circuit. The afc circuit is for the purpose of compensating for any tendency on the part of the transmitter oscillator to drift from its center frequency. This is described in paragraph 36*f*(3).

22. Crystal Oscillator-harmonic Generator V-3 (fig. 15)

a. GENERAL. The crystal oscillator-harmonic generator uses a twin-triode 3A5 tube, V–3. One triode section (pins 1 through 4) is used as a crystal oscillator of the untuned grid, grounded plate type. The second triode section (pins 4 through 7) is used as a tuned harmonic generator.

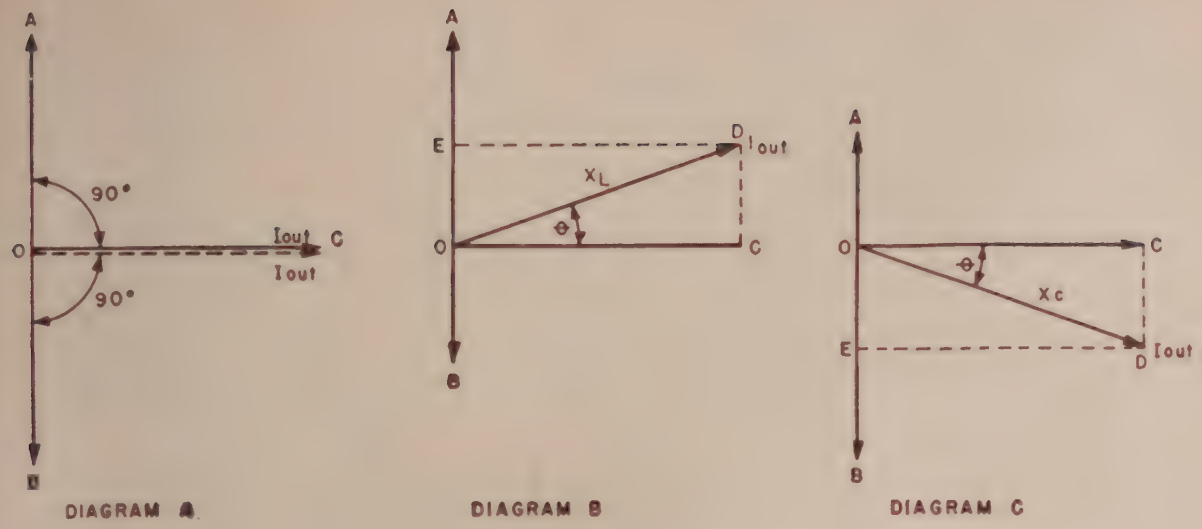
b. CRYSTAL OSCILLATOR (fig. 15).

(1) The plate (pin 2) of V–3 is placed at ground protential for rf by bypass capacitor C–11. Regenerative feedback from the plate filament circuit to the grid (pin 3), necessary to sustain oscillations, is established through capacitor C–12. The combination of filament chokes L–4 and L–5 and capacitor C–13 is resonant at a frequency below the oscillator frequency. Since this circuit shows a capacitive reactance to the oscillator frequencies, it provides a 90° phase shift to the plate filament current. The additional 90° phase shift provided by capacitor C–12 brings the total phase shift in the plate-to-grid feedback to the required 180°. The amount of feedback is determined by the voltage divider action of C–12 and C–13. The oscillator frequency is determined by the crystal connected across C–12 and C–13, between grid (pin 3) and ground. The oscillator generates the fundamental crystal frequency and a number of harmonics.

(2) The number of crystals used in each of the three sets is determined by the number of 1-mc intervals included in the frequency range covered by the sets. The crystals and the crystal selector switch are assembled in the crystal switch unit, S–1. The switch shaft is coupled mechanically to the shaft of the MCS control and capacitor C–17, which is used to tune the harmonic generator and harmonic amplifier circuits.

c. HARMONIC GENERATOR.

(1) The crystal oscillator output is taken across load resistor R–13 in the grid return circuit and applied directly to the grid of the harmonic generator triode. The plate circuit of the harmonic generator is tuned to resonance, at a harmonic of the crystal frequency, by the parallel circuit consisting of coil L–6 and section A of the harmonic generator and harmonic amplifier ganged tuning capacitor C–17. The resonant circuit is returned to ground through bypass capacitor C–19. Padder capacitor C–15 and variable trimmer capacitor C–16 serve to



$\overline{OA}$ = PLATE CURRENT FROM V-105
$\overline{OB}$ = PLATE CURRENT FROM V-106
$\overline{OC}$ = PLATE CURRENT FROM V-104A
$\overline{OE}$ = VECTOR DIFFERENCE ($\overline{OA}$ - $\overline{OB}$)
$\overline{OD}$ = RESULTANT CURRENT, VECTOR SUM ($\overline{OE}$ + $\overline{OC}$)
θ = PHASE ANGLE
X_L = INDUCTIVE REACTANCE
X_C = CAPACITIVE REACTANCE

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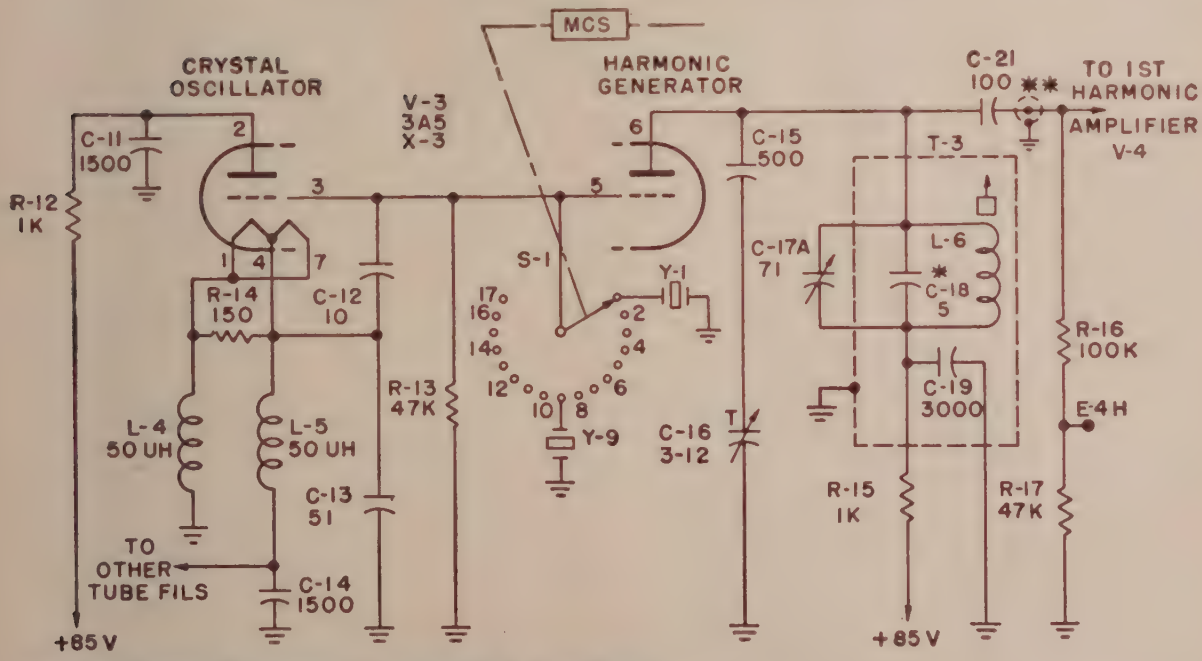
Figure 14. Reactance modulator, operation, vector diagram.



* C-18 NOT USED IN RECEIVER-TRANSMITTER RT-66/GRC
**COAX CABLE USED IN RECEIVER-TRANSMITTER RT-68/GRC ONLY

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Figure 15. Crystal oscillator-harmonic generator, functional diagram.

adjust the tracking. The inductance of L–6 is adjustable by means of the iron dust core. Fixed capacitor C–18 is a padder which changes the total capacity in the tuned circuit for Receiver-Transmitters RT–67/GRC and RT–68/GRC to enable tracking by capacitor C–17.

(2) Table I lists the crystal frequencies, and table II lists the corresponding harmonic frequencies used for each of the three receiver-transmitters. In the case of Receiver-Transmitter RT–66/GRC and Receiver-Transmitter RT–67/GRC, the plate circuit of the harmonic generator is tuned to the harmonic of the crystal which corresponds to the final frequency required at the grid of the receiver mixer tube, V–2. In the case of Receiver-Transmitter RT–68/GRC, a higher order of crystal harmonic is required over part of the band. In this case, the plate circuit of the harmonic generator selects a frequency which is one-half of the final frequency desired. This frequency is then doubled in the following harmonic amplifier stage.

(3) Capacitor C–17 is ganged with crystal switch S–1. It turns when the MCS control on the front panel is turned. It does not turn when the TENTH MCS control is turned.

d. D-C Circuits. Plate voltages for the two triode sections of V–3 are supplied directly from the 85-volt source through resistors R–12 and R–15, respectively. Capacitor C–11 is a plate bypass capacitor. C–19 and R–15 operate as a decoupling filter. The filament circuit is isolated from ground for rf by choke coils L–4 and L–5. Capacitor C–14 is a filament bypass capacitor. Resistor R–14, connected across the parallel arrangement of the two halves of the filament, serves as a shunt so that the current through the filaments will be the correct value.

23. Harmonic Amplifiers V–4 and V–5
(fig. 16)

The output of the crystal oscillator-harmonic generator is coupled through capacitor C–21 to a two-stage harmonic amplifier, V–4 and V–5. In the case of Receiver-Transmitter RT–68/GRC, amplifier V–4 has the additional function of doubling the frequency over part of the frequency range selected by the harmonic generator. The output of V–4 is applied to the receiver first mixer stage for the purpose of providing, in conjunction with incoming signals, the receiver first i.f. The output of the second harmonic amplifier stage, V–5, is applied to the transmitter mixer, in conjunction with the modulated output of the transmitter oscillator, V–104A, for the purpose of providing the final transmission frequency.

a. The first harmonic amplifier stage, V–4, uses a type 3Q4 pentode tube. In the case of Receiver-Transmitters RT–66/GRC and RT–67/GRC, the plate circuit is tuned to resonance at the harmonic selected by the tuned circuit of the harmonic generator. Receiver-Transmitter RT–68/GRC is tuned to twice that frequency over part of the band. The tuned circuit consists of coil L–8, section B of the gang capacitor, C–17, padder capacitors C–25 and C–27, and trimmer capacitor C–26. The padder capacitors are required for tracking.

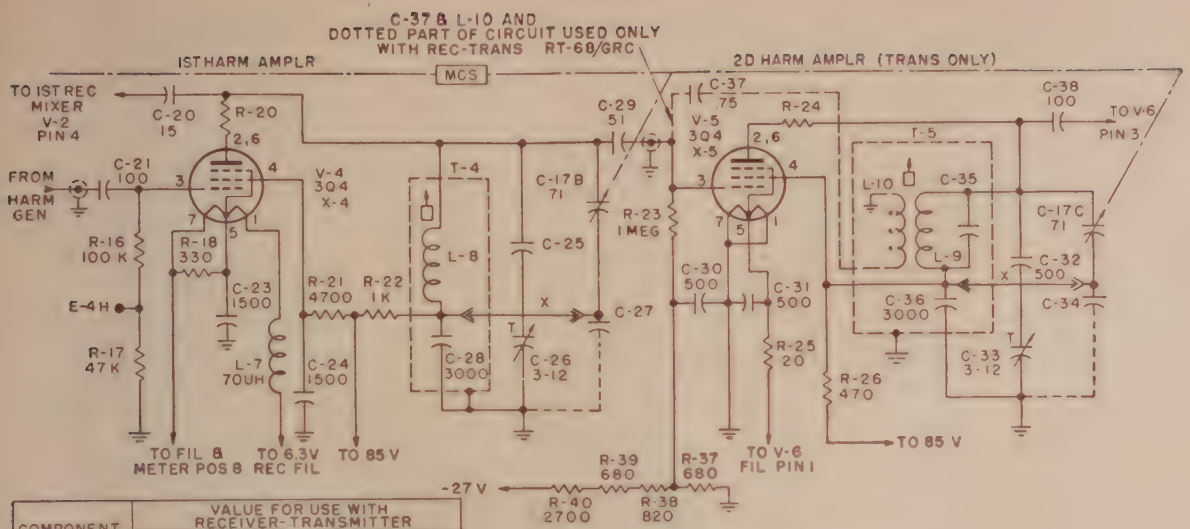
(1) Plate and screen voltages are applied to the stage from the 85-volt source through resistors R–22 and R–21, respectively. These resistors are bypassed to ground for r-f through bypass capacitors C–28 and C–24, respectively. Resistor R–20 is used only in Receiver-Transmitters RT–66/GRC and RT–67/GRC to suppress parasitic oscillations.

(2) The grid return circuit includes resistors R–16 and R–17. Resistor R–17 has the additional function of providing means for measuring grid drive on tube V–4. For this purpose, the junction of R–17 and R–16 is brought out to a test lug, E–4H. Measurement from E–4H to chassis gives the voltage drop across R–17 and indicates the grid drive.

(3) The filament circuit includes isolating choke L–7, filament bypass capacitor C–23, and current limiting resistor R–18. The lower potential side of the filament is connected to other filaments and is brought out through resistor R–19 to position 8 on the METER switch, S–301.

(4) The output of the first harmonic amplifier stage is coupled through capacitor C–20 to the receiver first mixer stage, V–2, and through capacitor C–29 to the grid circuit of the second harmonic amplifier stage, V–5.

b. The second harmonic amplifier stage, V–5, uses a type 3Q4 pentode tube. The plate circuit of V–5 includes coil L–9, section C of gang capacitor C–17,



COMPONENT	VALUE FOR USE WITH RECEIVER-TRANSMITTER		
	RT-66/GRC	RT-67/GRC	RT-68/GRC
R-20	150 OHMS	68 OHMS	*
R-24	150 OHMS	100 OHMS	*
C-27, C-34	**	**	1000 UUF
C-25	51	51	500UUF
C-35	12	20	10

* REPLACE BY WIRE CONNECTION

** DOTTED WIRING AND ASSOCIATED COMPONENTS USED IN REC-TRANS, RT-68/GRC ONLY. STRAP CONNECTIONS, X, USED IN REC-TRANS, RT-66/GRC AND RT-67/GRC ONLY.

Figure 16. Harmonic amplifier, functional diagram.

trimmer capacitor C–33, and padder capacitors C–32, C–34, and C–35. The circuit is tuned to resonance and selects the frequency required for application to the transmitter mixer. A neutralizing circuit (Receiver-Transmitter RT–68/GRC only), consisting of the secondary winding L–10 and capacitor C–37, returns a portion of the plate current to the grid circuit for the purpose of canceling out any tendency of the amplifier to break into oscillations. Plate and screen voltages for V–5 are applied directly from the 85-volt source through resistor R–26. Resistor R–24 is used only in Receiver-Transmitters RT–66/GRC and RT–67/GRC to suppress parasitic oscillations. D-c grid return is established through resistor R–23, which is grounded for rf through bypass capacitor C–30. Grid bias is obtained by connecting the grid to a tap (junction of R–37 and R–38) on the voltage divider (R–37, R–38, R–39, and R–40) across the external—27-volt bias supply. The filament circuit includes filament voltage-dropping resistor R–25 and bypass capacitor C–31. The output of V–5 is connected through coupling capacitor C–38 to the screen grid (pin 3) of the transmitter mixer stage, V–6.

24. Transmitter Mixer V-6 (fig. 17)

a. R-F Circuits. The transmitter mixer stage uses a type 3A4 pentode tube, V–6. The output of the second harmonic amplifier, V–5, is coupled to the screen grid (pin 3) through capacitor C–38. Ground return for that voltage is established through resistor R–29 and bypass capacitor C–44. The modulated output of the transmitter oscillator is fed through coupling capacitor C–122 to the control grid (pin 4). Ground return for rf is provided by grid resistor R–27 and bypass capacitor C–40. The tube combines the two signals. The sum frequencies are selected by a parallel resonant plate circuit and are applied through coupling capacitor C–47 to the input of the transmitter r-f stages, V–7 and V–8. The parallel resonant plate circuit of V–6 consists of coil L–12, section F of the r-f tuning capacitor, C–1, and variable trimmer capacitor C–1E. In RT–66/GRC, a fixed padder capacitor, C–77, connected across L–12 serves to facilitate tracking. The inductance of L–12 is adjustable by means of the powdered iron core. Tuning of the resonant circuit may also be adjusted for tracking by means of C–1E. The tuning range of the resonant circuit corresponds to that of the receiver-transmitter.

b. D-C Circuits. Plate and screen voltages are applied from the external 85-volt supply over contacts 8 and 9 of relay O–101 (when energized). R–31 and C–45 are the plate voltage-dropping resistor and r-f bypass capacitor, respectively. R–29 and C–44 are the screen grid voltage-dropping resistor and r-f by-

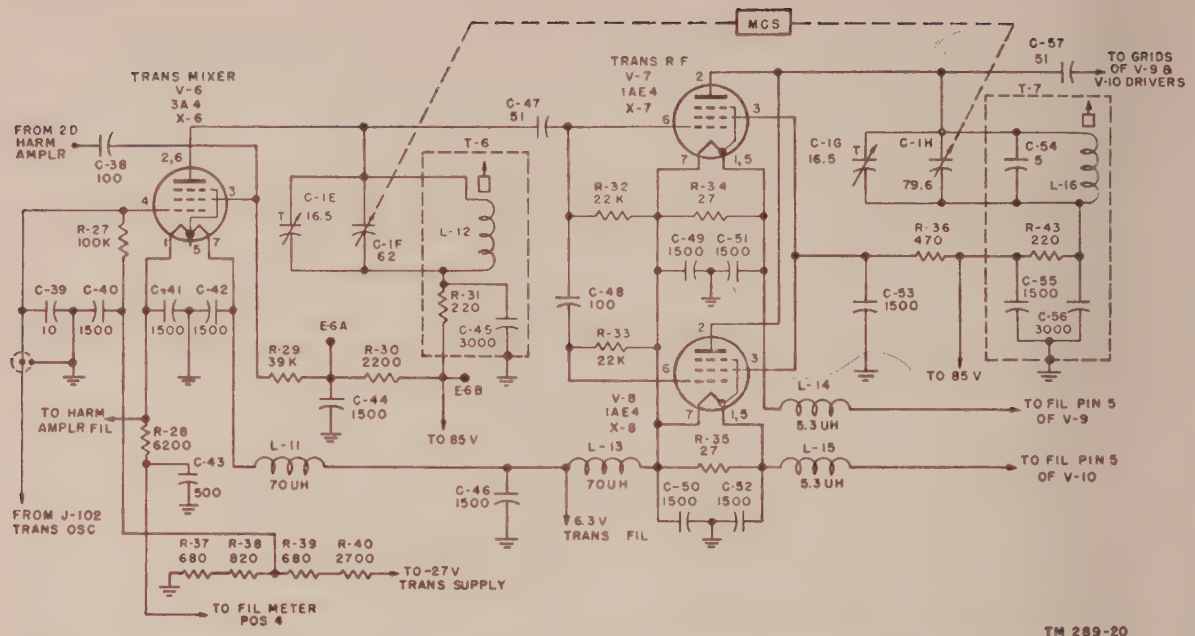


Figure 17. Transmitter mixer V–6 and r-f amplifier V–7 and V–8, functional diagram. In Receiver-Transmitter RT–66/GRC (1) add capacitor C–77 (5μμf), across L–12, (2) disconnect R–32 from pin 7 of V–7 and connect it to ground, and (3) disconnect R–33 from pin 7 of V–8 and connect it to ground.

pass capacitor, respectively. Fixed grid bias is obtained from a tap (junction of R–39 and R–38) on the voltage divider (R–37, R–38, R–39 and R–40) across the external—27-volt bias supply. Filament voltage is applied through isolating choke L–11. Capacitors C–41 and C–42 are filament bypass capacitors.

c. Measuring Circuits. Measuring resistor R–28 is shunted across the series string of filaments of which the filament of V–6 is one. It serves to connect position 4 of the METER switch, S–301, to the filaments of that string for the purpose of measuring continuity. Test points E–6A and E–6B serve as measuring points for determining the voltage applied to mixer V–6 by the second harmonic amplifier, V–5, by means of an external meter connected across measuring resistor R–30.

d. Circuit Differences. In Receiver-Transmitter RT–66/GRC, grid bias is provided by the voltage drop across resistors R–32 and R–33, which return the grids of V–7 and V–8, respectively, to ground.

25. Transmitter R-f Amplifiers V-7 and V-8 (fig. 17)

The transmitter r-f amplifier stage uses two type 1AE4 pentode tubes, V–7 and V–8, connected in parallel and operating Class B. The plates (pins 2) and the screen grids (pins 3) of these tubes are connected in parallel.

a. R-F Circuits. The output of mixer stage V–6 is applied through coupling capacitor C–47 to the grid of V–7 and through d-c blocking capacitor C–48 to the grid of V–8. The amplified output of the stage is developed across the parallel resonant plate circuit, consisting of coil L–16, section H of r-f tuning capacitor C–1, and trimmer capacitor C–1G. Fixed padder capacitor C–54 serves to adjust tracking. The inductance of L–16 is adjustable by means of the iron dust core. Tracking adjustment is made by means of trimmer C–1G. The tuning range of the stage is the same as that of the over-all receiver-transmitter. The r-f voltages are applied to the driver stage through coupling capacitor C–57.

b. D-C Circuits. Plate and screen voltages are applied from the external 85-volt source when contacts 8 and 9 of relay O–101 are closed. Plate voltage is supplied through resistor R–43, which is bypassed by capacitors C–55 and C–56. The latter capacitor returns the resonant circuit to ground for r-f voltages. Screen voltage is supplied through R–36, which is bypassed by C–53. Grid bias is provided by the voltage drop across the filament of the tube.

Resistors R–32 and R–33 return the grids of the tubes to the filaments for that purpose. Ground return for r-f voltages is provided by C–49 and C–50. Filament voltage is applied through the filter, consisting of isolating choke L–13 and bypass capacitors C–49 and C–50. Resistors R–34 and R–35 (across the tube filaments) limit the filament currents to their proper values. The filaments are bypassed to ground for r-f voltages by capacitors C–49 through C–52.

c. Mechanical Arrangement. For shielding purposes, coil L–16, padder C–54, plate supply resistor R–43, and bypass capacitors C–55 and C–56 are mounted in a common can, T–7, with a removable cover. The tuning slug of L–16 is accessible through a hole in the brace (fig. 7).

26. Transmitter Drivers V–9 and V–10

(fig. 18)

a. R-F Circuits. The transmitter driver stage uses two type 3B4 pentode tubes, V–9 and V–10, in parallel. The control grid (pin 3), the screen grid (pin 1), and the plate (pin 7) of one tube are directly connected to the corresponding elements of the other tube. The output of the transmitter r-f amplifier stage is coupled through capacitor C–57 to the grids (pin 3) of the tubes. The signal voltage is developed across grid leak resistor R–42, which is returned to ground for rf by capacitor C–59. Resistor R–41 provides a means for measuring the grid drive of V–9 and V–10. The measuring points are two feedthrough insulators, E–7B and E–8G, one on each side of R–41. The voltage across this resistor may be measured by means of an external meter. The plate circuit is tuned to resonance at the dial frequency by the parallel resonant circuit composed of coil L–18, section J of the r-f tuning capacitor, C–1, and trimmer capacitor C–1K. Tracking may be adjusted by means of the adjustable iron dust core of coil L–18 and also by means of trimmer capacitor C–1K. The series arrangement of coil L–17 (closely coupled to coil L–18) and variable capacitor C–65, connected from the junction of R–49 and the parallel resonant circuit to the grids of the tubes, is a neutralizing circuit serving to balance out the grid-to-plate capacity of the tubes and thus serving to prevent oscillatory feedback through that interelectrode capacity. The output of the transmitter driver is coupled to the transmitter power amplifier stage, V–11, through coupling capacitor C–67.

b. D-C Circuits. Plate and screen voltages are supplied from the 150-volt external source through resistors R–49 and R–46, respectively, when contacts 6 and 7 of relay O–1 are closed. The resistors are bypassed by capacitors C–66, C–68, and C–62, respectively. Fixed grid bias is obtained by connecting the grids through d-c return resistor R–42 and measuring resistor R–41 to the tap (junction of R–39 and R–40) on the voltage divider, R–37, R–38, R–39, and R–40, across the external —27-volt bias supply. Capacitor C–58 bypasses the bias supply for rf. The filaments of V–9 and V–10 are in series with the filaments of V–7 and V–8, respectively, and are energized when contacts 4–5 of relay O–101 are closed. Measuring resistors R–47 and R–48 extend the series strings of filaments, which include the filaments of V–9 and V–10, to positions 2 and 3, respectively, of the METER switch, S–301. Capacitors C–60 and C–61 are filament bypass capacitors.

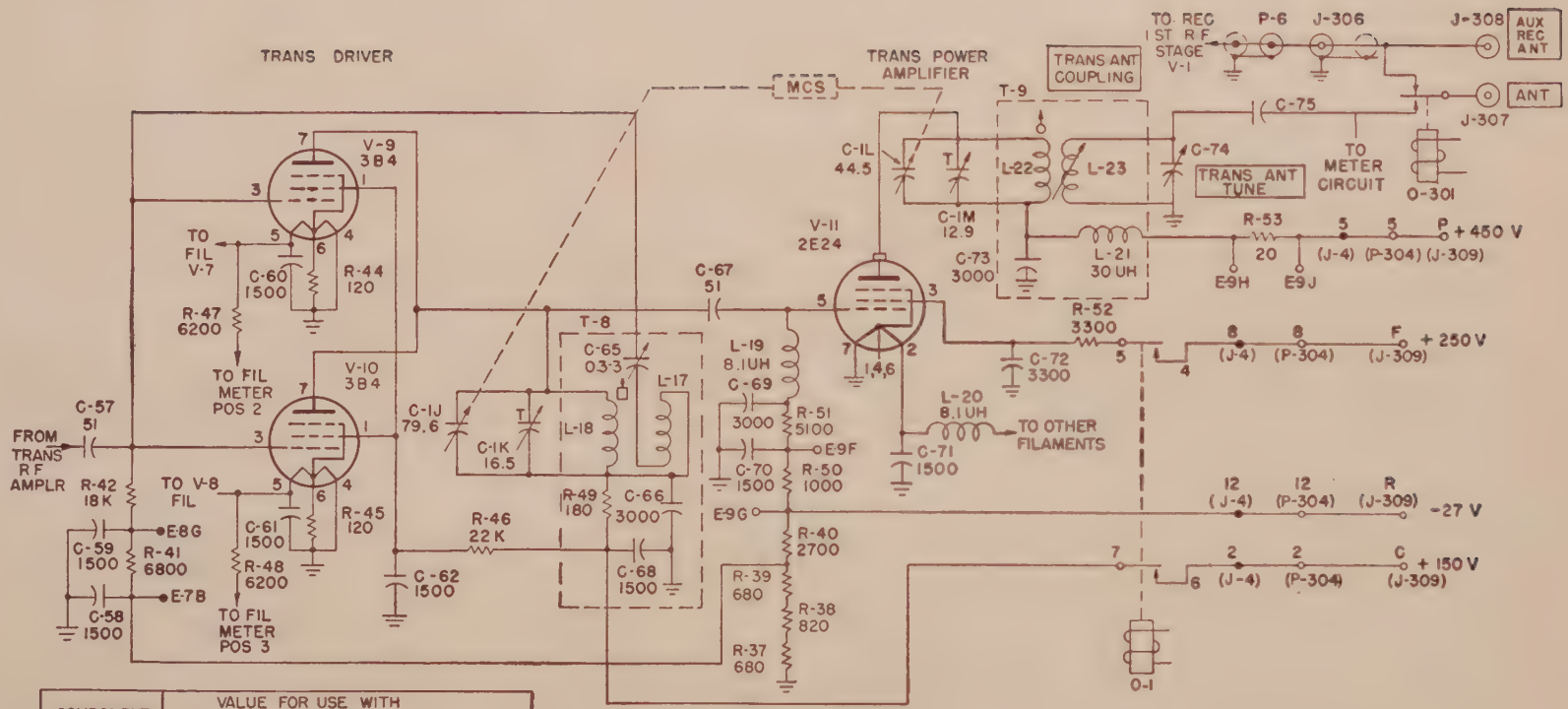
c. Neutralizing. The neutralizing circuit, L–17 and C–65, establishes negative voltage feedback from the plates to the grids of the tubes. Voltage feedback is used to cancel out any tendency of the tube to break into oscillations due to internal coupling by the interelectrode capacity of the tubes. This arrangement serves to provide for stable operation of this relatively high power stage.

d. Mechanical Arrangement. Tuning coil L–18, neutralizing coil L–17, neutralizing capacitor C–65, and bypass capacitors C–66 and C–68 are mounted in a common can, T–8. The location of the tuning adjustments for L–18 and C–65 are shown in figure 7.

27. Transmitter Power Amplifier V-11

(fig. 18)

a. R-F Circuits. The output stage or power amplifier of the transmitter uses a type 2E24 pentode tube, V–11, operating Class C. Grid drive, obtained from the output of the driver stage through coupling capacitor C–67, is developed across grid coil L–19 and is returned to ground through r-f bypass capacitor C–69. Coil L–19 serves to provide pre-emphasis at the higher transmission frequencies. Since the reactance of the coil increases with frequency, the signal voltage applied to the grid increases accordingly; thus greater amplification is obtained at the h-f end of each channel. The grid is returned to ground for rf through coil L–19 and bypass capacitor C–69. The plate circuit is tuned by the parallel resonant circuit, consisting of coil L–22, section L of r-f tuning capacitor C–1 and trimmer capacitor C–1M.



COMPONENT	VALUE FOR USE WITH RECEIVER TRANSMITTER		
	RT-66/GRC	RT-67/GRC	RT-68/GRC
C-74	20-216 UUF	14-172 UUF	12-138 UUF
C-75	REPLACED BY WIRE STRAP	24 UUF	REPLACED BY WIRE STRAP

Figure 18. Transmitter driver, power amplifier and antenna circuits, functional diagram. In Receiver-Transmitter RT-66/GRC, replace L-19 by a wire connection, delete C-69, change the value of R-51 to 1,800 ohms, and bring L-21 outside of T-9 with the same connections.

The signal voltage developed across this circuit is inductively coupled to the tuned antenna circuit, consisting of coil L–23 and variable capacitor C–74. The amount of coupling between the antenna circuit and the power amplifier tank is adjustable from the front panel by means of the TRANS-ANT COUPLING control, which moves L–23 closer to or farther from L–22 as required. Tracking is adjusted by means of trimmer capacitor C–1M. TR ANT TUNE capacitor C–74 tunes the antenna circuit as required for matching the antenna proper to the transmitter output circuits. This capacitor is rotated by the cam arrangement (par. 13).

b. D-C Circuits. Plate voltage is fed to the tube from the external 450-volt supply through measuring resistor R–53 and through filter coil L–21, which is bypassed by capacitor C–73. Screen voltage is fed from the external 250-volt supply over contacts 5 and 4 of relay O–1 (when energized) and through resistor R–52, which is bypassed by capacitor C–72. The filament supply circuit includes isolating choke L–20 and filament bypass capacitor C–71. D-c grid bias is taken from the external —27-volt bias supply through grid resistors R–51 and R–50 and coil L–19. The combination of R–51, L–19, and bypass capacitors C–69 and C–70 serves to isolate the rf from the d-c path.

c. Metering. Resistor R–50 provides means for measuring the grid drive applied to the power amplifier stage. Grid drive is taken in terms of the voltage drop across R–50. For this purpose, test points E–9G and E–9F, one on each side of the resistor, are brought out to terminals A of test socket J–3 (fig. 36). Power amplifier plate current readings are taken in terms of the voltage drop across measuring resistor R–53. Test points, E–9J and E–9H, one on each side of the resistor, are brought out to terminals B of J–3 (fig. 36). The RF position on the METER switch, S–301, is used to determine the presence of power amplifier output across the antenna circuit (par. 44).

d. Circuit Differences. In Receiver-Transmitter RT–66/GRC, grid drive, obtained from the output of the driver stage through coupling capacitor C–67, is developed across grid leak resistor R–51. The grid is returned to ground through R–51 and through r-f bypass capacitor C–70. D-c grid bias is taken from the external —27-volt supply through grid resistors R–50 and R–51. The combination of grid leak resistor R–51 and bypass capacitor C–70 serves to isolate the rf from the d-c paths.

28. Ringer Circuit
(fig. 19)

a. The ringer circuit includes an oscillator, designed to generate a 1,600-cycle signal, and the DIAL LIGHT (ON-OFF) RING switch, S–302. The switch, when turned to the RING position, turns on the transmitter, breaks the microphone circuit, energizes the oscillator, and applies its output to the input of the transmitter modulator circuit, for transmission like any other audio signal.

b. The ringer oscillator uses one section of the twin triode type 3A5 tube, V–104B, in a conventional tuned plate-untuned grid circuit. The other triode section of that tube is used as the transmitter oscillator (par. 20). The 1,600-cycle frequency generated by the oscillator is determined by the parallel resonant plate circuit, consisting of winding 3–4 of transformer T–105 and fixed capacitor C–143. Regenerative feedback from the plate (pin 2) to the grid (pin 3) is established by induction from winding 3–4 to winding 1–2 of T–105. The isolation network, capacitor C–140 and resistor R–127, in the grid circuit functions to decouple (or isolate) the plate from the grid to prevent the oscillator from being overloaded. Degenerative current feedback, established from the plate circuit to the grid circuit through bypass capacitor C–141 and resistor R–128, serves to stabilize the oscillator against changes in power supply potentials and variations in tube characteristics. The oscillator output is developed across secondary winding 5–6 of T–105, and is applied over terminals 8 of connectors P–308 and J–108, contacts 1–E (section 1 front) of switch S–302, and terminals 7 of J–108 and P–308 to input winding 4–5 of modulator input transformer T–106. From this point, the path of the ringing signal is the same as that of any microphone signal, as described in the preceding paragraphs.

c. Plate voltage for the ringer oscillator is routed from the 85-volt supply connected to terminal B of J–309, over terminals 7 of P–306 and J–106, over contacts 8–9 (normally opened) of relay O–101, over terminals 4 of J–106 and P–306, contacts 1–C (section 1 rear) of S–302 (RING position), terminals 6 of P–306 and J–106, through voltage dropping resistor R–129 and winding 4–3 of T–105 to the plate (pin 2) of tube V–104.

d. When switch S–302 is in the RING position, the contacts prepare the transmitter circuit for transmission of the ringing signal as follows:

(1) Contacts 1–E (section 1 front) connect the

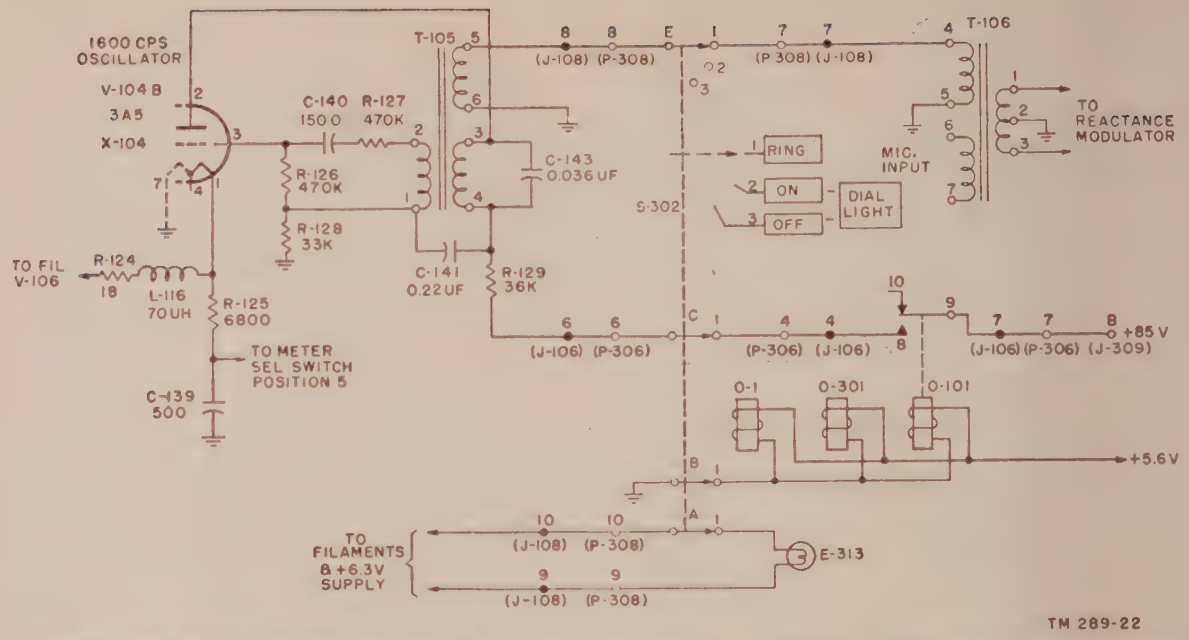


Figure 19. Ringer circuit, functional diagram. In Receiver-Transmitter RT-66/GRC, C-206 (1,500 μμf) is connected across winding 3-4 of T-105.

oscillator to the modulator input circuit (*a* above).

(2) Contacts 1–B (section 1 rear) apply ground return to the control relays, O–1, O–101, and O–301, and cause these relays to become energized, with the results that the transmitter is turned on and the receiver is turned off (par. 41).

(3) Contacts 1–C (section 1 rear) connect the plate circuit to the 85-volt supply (*c* above).

(4) Contacts 1–F (section 1 rear) open the microphone circuit connection to the modulator input transformer T–106.

(5) Contacts 1–A (section 1 rear) energize the dial light, E–313, by connecting it into the filament circuits.

e. In Receiver-Transmitter RT–66/GRC, the 1,600-cycle frequency generated by the oscillator is determined by the parallel resonant plate circuit, consisting of winding 3–4 of transformer T–105, and parallel fixed capacitors C–143 and C–206.

29. Receiver Antenna Circuit

(fig. 20)

a. The antenna, which is common to both the receiver and the transmitter, is plugged into the panel-mounted coaxial ANT connector, J/307. The antenna lead is over the normally closed contacts of relay O–301 and panel chassis connectors J–306 and P–6 to the r-f chassis where, by means of a coaxial cable, connection is made to a tap on tuning inductance L–1. Coil L–1 is tuned by section B of the ganged r-f tuning capacitor C–1, REC ANT TUNE trimmer capacitor C–1A, and fixed padder capacitor C–2.

b. The antenna tuning range is the same as that of the over-all receiver-transmitter. Tuning is controlled by both the MCS and TENTH MCS controls on the front panel. For alinement purposes, the inductance of L–1 is adjusted by means of the iron dust core to match the antenna to the receiver. Trimmer capacitor C–1A, used for fine adjustment of tuning or tracking, is accessible from the front panel where it is identified as REC ANT TUNE. The signal voltages developed across the antenna circuit are coupled through capacitor C–3 to the grid (pin 1) of the receiver r-f amplifier stage, V–1.

c. Tuning coil L–1, padder capacitor C–2, and coupling capacitor C–3 are mounted in a compartment identified as T–1.

d. In Receiver-Transmitter RT–66/GRC, add a 100-ohm resistor, R–56, connected between the tap on L–1 and the chassis. This resistor serves to load the antenna circuit. Tuning coil L–1, padder capaci-

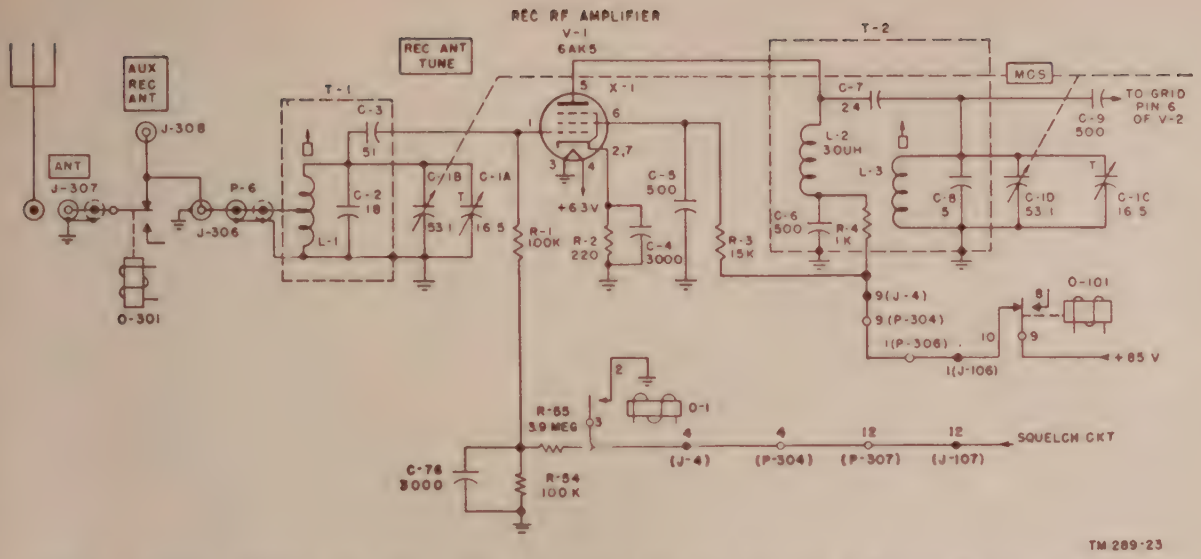


Figure 20. Receiver antenna circuit and r-f amplifier stages, functional diagram. In Receiver-Transmitter RT-66/GRC, delete R–2 and C–4; connect pins 2, 7 to ground; change the value of R–55 to 2.2 megohms; and change cathode terminal reference number from 2, 7 to 7.

tor C–2, coupling capacitor C/3, and loading resistor R–56 are mounted in the compartment identified as T–1.

30. Receiver R-f Amplifier V-1

(fig. 20)

a. The receiver r-f stage, V–1, uses a type 6AK5 pentode tube. Capacitor C–3 couples the antenna circuit to the grid (pin 1) of V–1. The grid circuit includes grid leak resistor R–1, which is returned to ground for rf through bypass capacitor C–76, and for dc through squelch bias resistor R–54. The tube is operated at the combination of bias voltages developed across cathode resistor R–2, which is bypassed for rf by capacitor C–4, and across squelch bias resistor R–54.

b. During stand-by with the squelch circuit operative, a bias voltage developed by the diode portion of V–103 is applied across the voltage divider circuit R–55 and R–54. The portion of the voltage developed across R–54 adds to the cathode bias voltage developed across R–2 to reduce the gain of this stage. When a signal enters the receiver antenna circuit, a bias is developed at the limiter grid (V–112). This bias disables the squelch circuit (par. 40). The output of the squelch diode is cut off and the bias voltage across R–54 is removed. Thus, V–1 is restored to normal operation at the cathode bias across R–2 alone. During transmit periods when relay O–1 is operated, contacts 2 and 3 close, short out the squelch diode load resistor, shunt R–55 across R–54, and effectively disconnect the grid circuit of V–1 from the squelch circuit. The purpose of this arrangement is as follows: it will be noted that during transmit periods, plate and screen voltages for V–1 are removed by the opening of contacts 9 and 10 of O–101. However, with filament voltage still present, a voltage might develop across R–54 during transmit periods by rectification of transmitter r-f voltage at the grid of V–1. This voltage applied through the squelch bias circuits to the audio tubes would tend to drive these tubes toward cut-off. During transmit periods, the audio tubes must be operative to permit sidetone to pass through to the headphones. The arrangement of the relay contacts described above insures that the audio tubes will remain operative. For details of squelch circuit operation, refer to paragraph 40. Since the value of R–55 is very high, its shunting effect on the d-c grid path, R–54, and on the a-c return path, C–76, is negligible.

c. The plate circuit includes the parallel resonant circuit composed of tuning inductance L–3, section D of the ganged r-f tuning capacitor, C–1, trimmer capacitor C–1C, and padder capacitor C–8. Trimmer capacitor C–1C and the powdered iron core of L–3 are used to adjust the alinement of the stage.

d. Voltage for the plate (pin 5) is shunt-fed through voltage dropping resistor R–4, which is by-

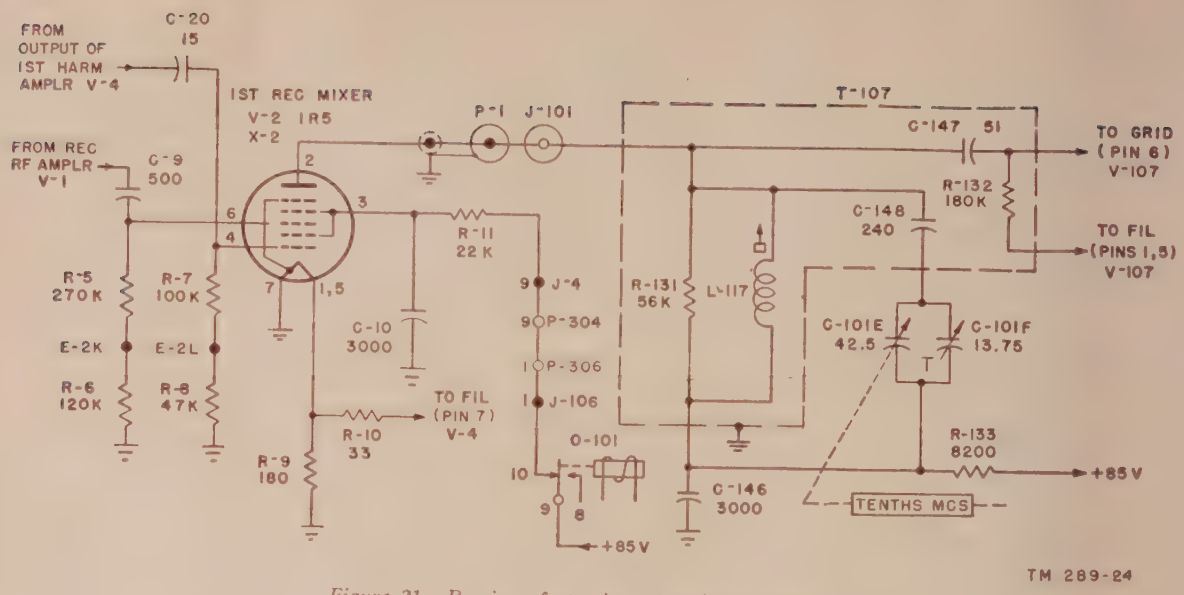


Figure 21. Receiver first mixer, functional diagram.

passed for rf by capacitor C–6, and through choke coil L–2. The plate voltage for this stage is obtained from the 85-volt input terminal (terminal B) of J–309, through the normally closed contacts 9–10 of relay O–101. Capacitor C–7 functions to block d-c currents from the tuned plate circuit. The 85-volt supply circuit for the screen (pin 6) includes the normally closed contacts 9–10 of relay O–101, and screen voltage dropping resistor R–3, which is bypassed by capacitor C–5. Filament voltage is obtained directly from the external 6-volt supply.

e. The output of V–1 is coupled through capacitor C–9 to the grid circuit of the receiver first mixer stage, V–2. The plate circuit components, L–2, L–3, C–6 through C–8, and R–4 are assembled in a can identified as T–2. The tuning slug for L–3 is accessible through the cover of the can.

f. In Receiver-Transmitter RT–66/GRC, the cathode of tube V–1 is connected directly to ground. The tube is operated at zero fixed bias during signal reception periods, and at the bias developed across squelch bias resistor R–54 during stand-by periods when the squelch oscillator (par. 40) is operative.

31. Receiver First Mixer V-2
(fig. 21)

a. The first mixer stage uses a type 1R5 pentagrid converter tube, V–2. Signal voltage injection takes place at the second grid (pin 6) of the tube through coupling capacitor C–9. This grid is returned to ground through grid leak resistors R–5 and R–6. Resistor R–6, in series with R–5, provides means for measuring the applied signal voltage. Measurement is made between test point E–2K and ground.

b. The heterodyne frequency is taken from the output of the first harmonic amplifier stage, V–4 (par. 23), and is applied through coupling capacitor C–20 to the first grid (pin 4) of V–2. The first grid is returned to ground through grid resistors R–7 and R–8. Resistor R–8, in series with R–7, provides means for measuring the applied heterodyne voltage. Measurement is made between test point E–2L and ground.

c. The incoming signal frequencies and the heterodyne frequency are caused to beat against each other in V–2 to produce difference frequencies. Since the harmonic amplifier frequency is below the signal frequency by some amount between 4.45 and 5.45 mc (depending upon the settings of the MCS and TENTH MCS controls on the front panel), the difference frequency produced in V–2 lies between 4.45 and 5.45 mc. This is the first i-f range of the receiver, and is selected by the tuned plate circuit of V–2 (*d* below). In addition to the difference frequencies, the mixer also produces both of the incoming signal frequencies, sum frequencies, and harmonics of the incoming, the sum and the difference frequencies. These are effectively rejected by the high Q of the tuned circuit.

d. The tuned plate circuit components of V–2 are located on the i-f chassis. The plate (pin 2) of V–2

is connected through a coaxial cable and interchassis connectors P–1 and J–101 to the parallel resonant circuit composed of tuning coil L–117 and section E of the ganged variable i-f tuning capacitor, C–101. The circuit is tuned to resonance at some frequency between 4.45 and 5.45 mc. The particular frequency to which it is tuned depends on the setting of the TENTH MCS control on the front panel. Fixed padder capacitor C–148 serves to adjust the capacity of the tuned circuit to permit tracking with the receiver oscillator, V–101 (par. 33). For alinement purposes, adjustment is made by means of trimmer capacitor C–101F. The inductance of the tuned circuit is adjustable by means of the powdered iron core of L–117. Damping resistor R–131 serves to broaden the response of the tuned circuit.

e. Plate voltage is supplied through voltage-dropping resistor R–133, which is bypassed to ground by capacitor C–146. Screen voltage is applied through resistor R–11 which is bypassed by capacitor C–10. The plate voltage is obtained directly from the 85-volt source and is not controlled by the contacts of relay O–101. Screen voltage is controlled by the contacts of relay O–101. The filament circuit includes voltage-dropping resistor R–10 and current shunting resistor R–9. The output of the mixer stage is coupled through capacitor C–147 to the grid of the first variable i-f amplifier stage, V–107.

f. The plate circuit components of V–2, coupling capacitor C–147, and the grid leak resistor of the first variable i-f amplifier stage, V–107, are included in a can identified as T–107.

32. Variable I-f Amplifiers V–107 and V–108
(fig. 22)

a. The output of the receiver first mixer stage is amplified in a two-stage variable tuned i-f amplifier, V–107 and V–108. Each stage uses a type 1U4 pentode tube. The plate circuit of each stage is tuned to resonance at the i.f between 4.45 and 5.45 mc by sections of the variable i-f ganged capacitor C–101. Other sections of this capacitor tune the receiver first mixer, the receiver oscillator, V–101, and the transmitter oscillator, V–104A. Tuning is accomplished by means of the TENTH MCS control on the front panel. The variable i-f amplifier is designed to pass an 85-kc band of frequencies centered about the i.f. to which the circuit is tuned by the ganged capacitor, C–101.

b. The grid (pin 6) of the first variable i-f amplifier stage, V–107, is placed at filament potential by current limiting grid leak resistor R–132, and is returned to ground for i.f. through the low resistance of the filament and filament bypass capacitor C–149. The plate circuit is tuned to resonance at the first i.f. between 4.45 and 5.45 mc by the parallel resonant circuit composed of variable inductance L–118 and section G of the variable i-f tuning capacitor C–101. Padder capacities C–151 and C–152 serve to adjust the total capacity of the tuned circuit to facilitate tracking. Tracking adjustment is made by means of trimmer capacitor C-101H and the powdered iron core of L–118. To broaden the response of the amplifier stage, damping resistor R–134 is placed across the tuned circuit. Plate and screen potentials are applied through voltage-dropping resistor R–136, which is bypassed by capacitor C–150. For filament circuit details, refer to paragraph 42. The plate circuit components of V–107 and the grid circuit components of the second variable i-f amplifier, V–108, are assembled in can T–108.

c. The second variable i-f amplifier stage, V–108, is very similar in circuit arrangement to the first stage, V–107. The grid circuit includes coupling capacitor C–153 which applies the output of V–107 to the grid (pin 6) of V–108. Resistor R–135 returns the grid to the filament for dc and is placed at ground potential for i-f through filament bypass capacitor C–154. The plate circuit is double-tuned to resonance at the variable i-f as selected by the ganged i-f tuning capacitor, C–101. The primary tuned circuit includes tuning inductance L–119, feedback coil L–121, tuning capacitor C–101J, trimmer capacitor C–101K, and shunt and series padder capacitors C–156 and C–157. The function of feedback coil L–121 is to change the coupling between the primary and secondary windings of the plate inductance in order to broaden the frequency response of the stage. The secondary circuit includes tuning inductance L–120, tuning capacitor C–101L, trimmer capacitor C–101M, and shunt and series padder capacitors C–160 and C–159. Plate voltage is supplied through voltage-dropping resistor R–138 which is bypassed by capacitor C–158. Screen voltage is applied through voltage-dropping resistor R–137 which is bypassed by capacitor C–155. Double tuning with overcoupling by means of L–121 is used to broaden the bandwidth of the i-f amplifier as required to pass an 85-kc band of frequencies centered about the nominal first i-f selected by the tuning controls. The output of the second variable i-f amplifier is coupled through capacitor C–161 to the input of the receiver second mixer stage, V–109.

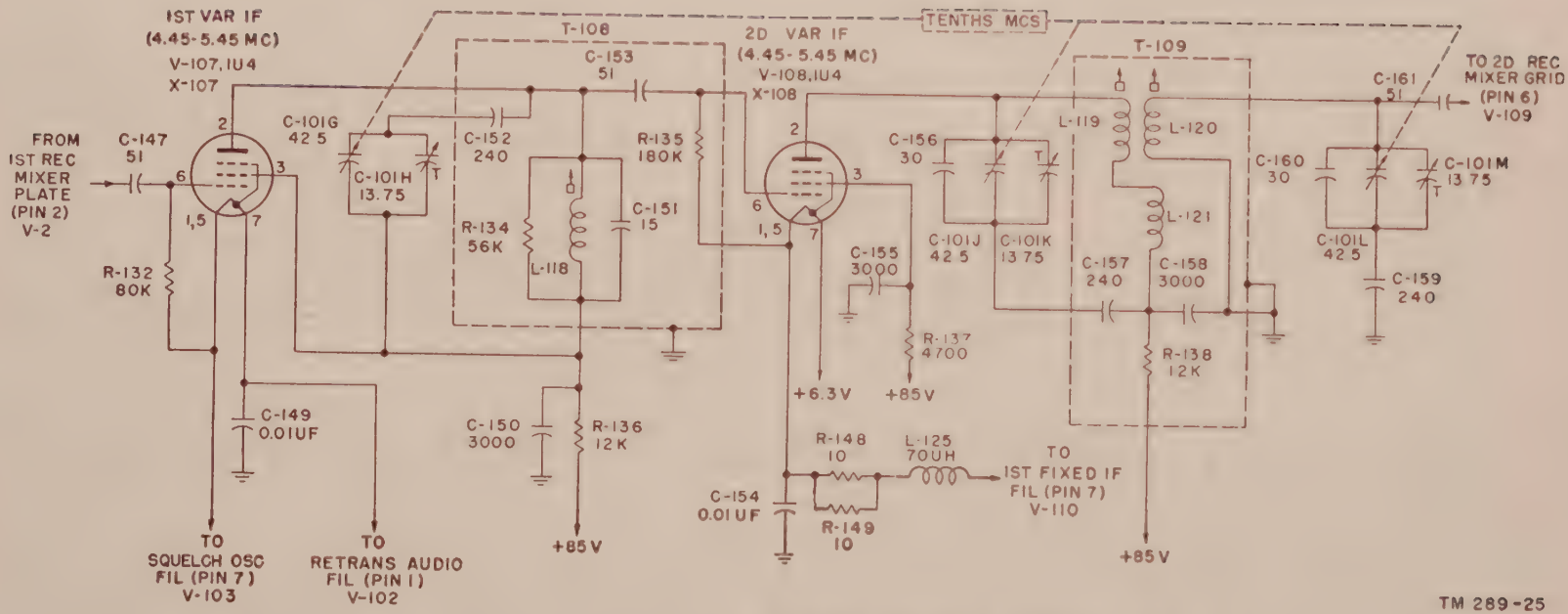


Figure 22. Variable i-f amplifier, functional diagram. In Receiver-Transmitter RT-66/GRC, shift the connection of C-149 from pin 7 of V-107, to pin 1 or 5 of V-107, delete the lead from pin 7 of V-107 and the reference "TO RETRANS AUDIO FIL (PIN 1) V-102," and connect pin 7 of V-107 to ground.

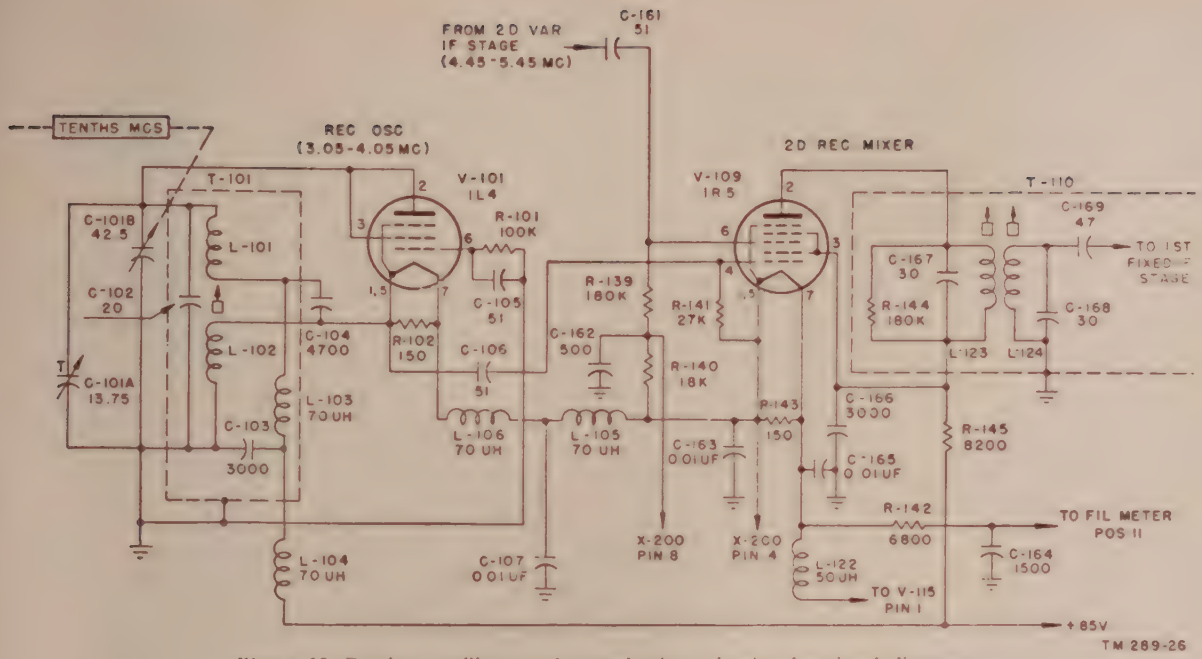


Figure 23. Receiver oscillator and second mixer circuits, functional diagram.

d. In Receiver-Transmitter RT–66/GRC, the grid (pin 6) of the first variable i-f amplifier stage, V–107, is placed at filament potential by current limiting grid leak resistor R–132 and is returned to ground for l.f. through filament bypass capacitor C–149, which is connected to the filament (pin 1, 5) of the tube.

33. Receiver Oscillator V–101
(fig. 23)

a. The self-excited receiver oscillator uses a type 1L4 pentode tube, V–101. The tube is used as a triode by connecting the plate (pin 2) and the screen grid (pin 3). The circuit is a modified Hartley type, similar to the one used for the transmitter oscillator, V–104A (par. 20). The tuning range of the oscillator is 3.05 to 4.05 mc.

b. Plate coil L–101 and grid coil L–102 form the conventional Hartley inductive voltage dividing circuit. Capacitor C–105 couples the grid (pin 6) through ground to the tank circuit. Capacitor C–104, in the electrical center of the tank circuit, serves as a plate supply bypass and d-c blocking capacitor. Regenerative feedback from the plate to the grid circuit is provided by induction from coil L–101 to L–102. The feedback voltage is coupled to the grid by capacitor C–105. The amount of feedback is determined by the turns ratio of the two tank coils.

c. The nominal or center frequency generated by the oscillator is determined by the parallel resonant tank circuit consisting of coils L–101 and L–102, section B of the variable i-f gang capacitor, C–101, shunt padder capacitor C–102, and trimmer capacitor C–101A. The padder capacitor serves to facilitate tracking of the oscillator with the tuned circuits of the receiver variable i-f amplifier, and of the transmitter oscillator. The center frequency is set during alinement by the adjustment of trimmer capacitor C–101A and of the inductances of coils L–101 and L–102 by means of the iron dust cores, so that the difference between the variable i. f. and the oscillator frequency is 1.4 mc.

d. Plate voltage is applied to the plate (pin 2) from the 85-volt source through filter chokes L–104 and L–103 and through plate coil L–101. The plate supply is bypassed by capacitors C–103 and C–104. Resistor R–102 is shunted across the filament to provide proper current through the filament. Chokes L–106 and L–105 and filter capacitor C–107 isolate the filament circuit for intermediate frequencies. Bias for the operation of the tube is determined by the voltage drop across grid coil L–102 and by the time constant of C–105 and R–101. The oscillator output developed across grid coil L–102 is coupled through capacitor C–106 to the grid (pin 4) of the receiver second mixer, V–109.

c. The oscillator tank circuit components, L–101, L–102, C–102, filter choke L–103, and bypass capacitor C–103, are inclosed in tuning assembly T–101.

34. Receiver Second Mixer
(fig. 23)

a. The receiver second mixer is very similar to the receiver first mixer. It uses a type 1R5 pentagrid converter tube V–109 to mix the output of the receiver-oscillator with that of the second variable i-f amplifier stage to provide the second i. f. of 1.4 mc.

b. The output of the second variable i-f amplifier stage, V–108, is coupled through capacitor C–161 to the signal grid (pin 6) of V–109. The output of the receiver-oscillator is coupled through capacitor C–106 to the oscillator injector grid (pin 4) of V–109. The grid (pin 6) is returned to filament through grid leak resistors R–139 and R–140. Resistor R–140 is a measuring resistor and is bypassed by capacitor C–162. The first grid (pin 4) is returned to filament by grid leak resistor R–141. The plate circuit is double-tuned to resonance at 1.4 mc. The primary tuned circuit consists of coil L–123, fixed tuning capacitor C–167, and damping resistor R–144. The secondary circuit is tuned to resonance by coil L–124 and fixed capacitor C–168. Double-tuning and damping resistor R–144 is used to provide a broad enough response to the tuned circuit to permit a band of 85 kc to pass through. Alinement adjustment of the tuned circuit is accomplished by means of the powdered iron cores in the primary and secondary coils. The output of the second mixer is coupled through capacitor C–169 to the grid of the first fixed i-f stage V–110.

c. Plate and screen potentials are applied from the 85-volt supply through voltage-dropping resistor R–145, which is bypassed by capacitor C–166. Resistor R–143 shunts the filament to provide proper current through the filament. Filament voltage is supplied through isolating choke L–122 which is bypassed by capacitor C–165.

d. Means are provided for measuring the signal voltage applied to the grid (pin 6) of the receiver mixer by bringing the junction of resistors R–140 and R–139 to pin 8 on test socket X–200. The signal voltage drop across resistor R–140 may be measured between pins 8 and 1 (ground) of X–200. Resistor R–142, which is bypassed by capacitor C–164, connects the string of filaments (V–109 is one) to position 11 on the METER switch, S–301. Another filament voltage measuring point is provided at pin 4 of X–200 and is bypassed by capacitor C–163.

35. Fixed I–f Amplifier Limiter Circuit
(fig. 24. *See insert in back of manual*)

a. First Fixed I-F Amplifier V–110. The 1.4-mc i-f band is selected from the output of the receiver second mixer. V–109, by the double-tuned circuit in tuning assembly T–110 (par. 34), and coupled through capacitor C–169 to the grid (pin 6) of the first fixed i-f amplifier stage V–110, a type 1U4 pentode.

(1) Coupling capacitor C–169 has the additional function of blocking any d-c current which may be flowing in the filament to grid circuit of V–110 from the tuned secondary coil L–124 of T–110. The d-c return path to the grid is established through grid leak resistors R–146 and R–147. The grid leak resistor has the additional function of limiting grid current flow for very strong signals. The d-c bias voltage may be measured across resistor R–147 which is bypassed by capacitor C–170. A-c measurement from the grid (pin 6) to ground gives indication of the driving voltage provided by the signal, since C–170 effectively returns the grid to ground for signal frequencies.

(2) The double-tuned plate circuit of V–110 is identical in circuit arrangement and component values to the components in tuning assembly T–110 (par. 34). The primary tuned circuit includes coil L–126, fixed tuning capacitor C–172, and damping resistor R–151. The secondary tuned circuit includes coil L–127 and fixed tuning capacitor C–175. As in the case of tuning assembly T–110, double tuning provides a high degree of i-f selectivity while maintaining the desired bandwidth. The bandwidth is determined by overcoupling between the primary and secondary coils. In addition, the resistive load provided by R–151 flattens out the frequency response of the tuned circuit. The 85-kc band, centered about 1.4 mc selected by the tuned circuit, is coupled to the input of the first limiter stage, V–111, through capacitor C–176.

(3) Plate and screen voltages are applied through voltage-dropping resistor R–152

which is bypassed by filter capacitor C–173. Capacitor C–174 bypasses the filament to ground for signal frequencies. Measuring resistor R–150 connects the filament circuit to position 10 of METER switch S–301.

(4) The components of the tuned circuit, coupling capacitor C–176, and the grid circuit components of V–111 are included in tuning assembly T–111.

b. First Limiter Stage V–111. The first limiter stage V–111 also uses a type 1U4 pentode tube. The circuit arrangement and the values of the components in this stage are identical to those of the first fixed i-f amplifier, V–110. However, the stage has the dual function of providing further amplification to the signal band centered about 1.4 mc and eliminating any amplitude variations which may have been superimposed upon strong signals. Limiting action of this and the following stage is described in *d* below.

(1) The series arrangement of grid leak resistor R–153 and measuring resistor R–154 provides the d-c return path for the grid to the filament of the tube. The return path to ground for signal frequencies is established through bypass capacitor C–177, which also serves to bypass measuring resistor R–154 for signal frequencies. The measuring point is taken from the junction of R–153 and R–154 and brought to terminal 3 on measuring socket X–200.

(2) The double-tuned plate circuit is resonant at 1.4 mc and designed to pass an 85-kc band of frequencies. The primary tuned circuit includes tuning coil L–129, fixed tuning capacitor C–181, and damping resistor R–155. The secondary tuned circuit includes L–130 and fixed tuning capacitor C–182. These components, coupling capacitor C–183 and the grid circuit components of the secondary limiter stage V–112, are all mounted in a tuning assembly T–112.

(3) Plate and screen potentials are applied through voltage-dropping resistor R–156 which is bypassed by capacitor C–180. The filament is bypassed to ground by capacitors C–179 and C–178. The amplified and limited output of this stage is selected by tuning assembly T–112 and is coupled by capacitor C–183 to the grid of the second limiter stage, V–112. A portion of the output of the first limiter is coupled through resistor R–111 to the grid of the squelch oscillator tube, V–103. The action of the squelch oscillator or squelch circuit is described in paragraph 40.

c. Second Limiter Stage V–112.

(1) The second limiter stage uses a type 1L4 pentode tube, V–112. This tube is selected to obtain sufficient signal voltage to operate the following discriminator circuit. The output of first limiter stage V–111 is coupled through capacitor C–183 to the grid of V–112. The grid circuit return path includes grid leak resistor R–157 and measuring resistor R–158, which is bypassed for signal frequencies by capacitor C–184. For measurement of grid drive, the junction of R–157 and R–158 is brought to pin 5 of test socket X–200.

(2) The plate circuit components of the second limiter stage are assembled in tuning assembly T–113. The primary circuit includes coil L–132 and fixed tuning capacitor C–187. It will be noted that no damping resistor is provided in this case. The secondary tuned circuit includes two balanced coils L–133 and L–134, shunted by the series arrangement of capacitors C–188 and C–189. Both the primary and the secondary circuits are tuned to resonance at 1.4 mc and the coupling between them is such that an 85-kc band of frequencies centered about 1.4 mc is selected. The secondary circuit is a portion of the discriminator stage and is described in conjunction with that stage in paragraph 36.

(3) Plate and screen potentials for the second limiter stage are supplied through resistor R–160 which is bypassed by capacitor C–186. For arrangement of the filament circuit, refer to paragraph 42.

(4) The signal voltages developed across the primary tuned circuit are applied over two paths to the secondary tuned circuit of the discriminator. One path is through inductive coupling between primary coil L–132 and the secondary coils L–133 and L–134. The other path is a direct connection from the plate (pin 2) of V–112 to the center tap between capacitors C–188 and C–189 (par. 36).

d. Limiting Action. The first and second lim-

iter stages have the dual functions of amplifying the 1.4-mc band of frequencies and of eliminating or reducing any amplitude variations which may have been superimposed upon the signal in its travel from the distant transmitter through the air and through the preceding stages of the receiver. It should be noted that any noise present at the receiver input or in the earlier stages of the receiver is superimposed upon the signal as amplitude variations.

(1) Proper operation of the discriminator circuit requires that the signal applied to it be free of amplitude variations due to bursts of noise, static, and other causes, and that for wide variations in the strength of incoming signals, the average signal voltage applied to the discriminator input circuit remains fairly constant. The circuit parameters of the fixed i-f amplifier and limiter stages are arranged to make both of these functions possible.

(2) When the signal voltage appearing across the grid circuit of V–110, V–111, or V–112 exceeds a certain value, an increase in grid current causes limiting action or cut-off of the signal peaks for one half-cycle of the signal voltage, while plate current saturation causes similar limiter action to the other half-cycle of the signal voltage. In this manner, limiting of amplitude variations is accomplished in both the grid and plate circuits. When the average signal level is higher than that necessary to produce the required 2 volts across the discriminator input, the grid current is increased to the point where grid current rectification occurs. The d-c grid current then flows through the associated grid leak resistor and develops a voltage across it which is negative at the grid (pin 6) of the tube. This negative voltage tends to bias the tube toward cut-off, thereby reducing the gain of the stage accordingly.

(3) While inherently all three stages of the fixed i-f amplifier limiter circuit are capable of providing the action described above, the gain of the receiver is such that the signal voltage levels across the grid circuit of the first fixed i-f amplifier stage normally are not high enough to start limiting action there. Thus, limiting action normally is confined to the first and second limiter stages and their designation as such is derived from this fact.

(4) When the receiver is in stand-by condition and no signal is being received, the noise voltages in the antenna and the internal noises, inherent in the r-f stages of this and any high gain circuit, are amplified by the several receiver stages. The amplification is sufficient to produce a voltage across the input to the second limiter, V–112, to cause limiting action with grid current rectification to take place. Grid current rectification causes a reduction in the gain of that stage. Normally, under no signal conditions, that stage operates at reduced gain.

(5) When a signal, having the strength equivalent to the threshold of sensitivity of the receiver, enters the antenna circuit, the voltage across the input to the first limiter, V–111, is raised to the point where the noise voltages (which normally are superimposed upon the incoming signal as amplitude modulation) are cut off by plate current saturation and by an increase in the grid current flow in the first limiter stage. This limiting action then is supplemented by the limiting action of the second limiter stage.

(6) When very strong signals are received, the signal voltage across the first limiter stage is increased to the point where grid current rectification and a consequent reduction in the gain of the stage takes place. The reduced output of this stage prevents the second limiter stage from biasing itself to cut-off.

(7) The following is a summary of the limiting action described above. The first and second limiter stages eliminate any amplitude variations in the incoming signal. Such amplitude variations represent noises and are undesirable. In addition, it is necessary for the proper functioning of the discriminator circuit that the signal applied to it be approximately uniform in level regardless of the strength of the incoming signal. The gain of the receiver is sufficient to raise the level of the random noise to a value necessary to overload tube V–112, the second limiter stage. Grid current flowing through resistor R–157 in the grid circuit of that

tube biases the tube toward the cut-off region and reduces the gain of the stage. Thus, the receiver normally operates at reduced gain due to the limiting action which takes place in V–112. When a signal is received, tube V–111 tends to overload and limits its output in a similar fashion. This reduction in output of V–111 is translated in terms of a reduced negative bias on the grid of V–112. This tends to raise the gain of V–112 proportionately and prevent the output of that tube from falling off excessively because of overloading on strong signals. For weak signals, the gain of V–112 is increased. For strong signals, the gain of that stage is reduced. The net result is that the output voltage of V–112 is kept fairly constant. The above also explains why the grid circuit of V–112 is chosen as the control for the squelch oscillator.

e. Circuit Differences. In Receiver-Transmitter RT–66/GRC, use a type 1L4 pentode tube instead of a type 1U4 for V–110. Also, note that a portion of the input (not the output) to the first limiter is coupled through resistor R–111 to the grid of the squelch oscillator tube, V–103. The grid circuit of V–111 is chosen as the control for the squelch oscillator because the signal at V–111 is high enough for squelch control in Receiver-Transmitter RT–66/GRC.

36. Discriminator Circuit V–113 and V–114

(figs. 25 and 26)

a. Discriminator Function. Figure 25 is a functional diagram of the discriminator circuit used in Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC. The discriminator functions to convert frequency variation of the incoming signal into audio frequencies for application to the a-f amplifier stages. Frequency variations of the signal from the 1.4-mc center frequency at the input to the discriminator are translated into amplitude variations. The rate with which the frequency varies from the 1.4-mc center frequency is translated into the rate at which the amplitude variation of the voltage at the output of the discriminator changes. Since the rate of change of the signal frequency from 1.4-mc is the a-f rate, the rate of changes in the amplitude of the output voltage from the discriminator is the af.

b. Circuit Arrangement. The discriminator circuit includes the secondary tuned circuit in tuning assembly T–113, diode tubes V–113 and V–114, and the output load resistors and capacitors. The tuned portion of the discriminator circuit in T–113 consists of two balanced coils, L–133 and L–134. These are shunted by two balanced capacitors, C–188 and C–189. The inductance of each of the coils is equal to the inductance of the primary coil, L–132. Each of the two capacitors, C–188 and C–189, is equal in value to the capacity of C–187 in the primary circuit. The combined values of C–188 and C–189 tune the total inductance provided by L–133 and L–134 to resonance at 1.4-mc. Capacitors C–188 and C–189 have the additional functions of blocking d-c current from flowing through the discriminator coils and of maintaining the discriminator balance for signal frequencies. The plate of second limiter stage V–112 is connected to the center tap between capacitors C–188 and C–189. In effect, this connection is electrically the same as the center tap between coils L–133 and L–134. The rectifier circuit consists of two vacuum-tube diodes (each a type 1A3), tubes V–113 and V–114, rectifier load resistors R–164 and R–165, capacitor C–193 which bypasses the load resistors for radio frequencies, and the load circuit balancing resistors, R–167, R–168, and R–169. The voltage drop across R–168 provides means for measuring the output of the discriminator. Resistor R–166, connected to the tap between R–164 and R–165, is an isolating resistor permitting measurements of discriminator voltages to be made.

c. Discriminator Operation. The output of the second limiter stage V–112, is connected to the discriminator circuit over two paths. One path is by direct connection from the plate (pin 2) of V–112 to the electrical center of the discriminator, at the junction of capacitors C–188 and C–189. The other path is by inductive coupling from the primary resonant circuit (coil L–132) to the secondary resonant circuit (L–133 and L–134).

(1) The voltages applied to the diode plates through capacitors C–188 and C–189, by direct connection from the plate of V–112, are equal to each other and, at all times, are in phase with each other and with the plate voltage of V–112. At resonance, when a 1.4-mc signal enters, the primary and secondary tuned circuits are essentially resistive impedances and no reactive component is imparted to the signal voltage by the coils and capacitors. Thus, the signal voltage developed across primary coil

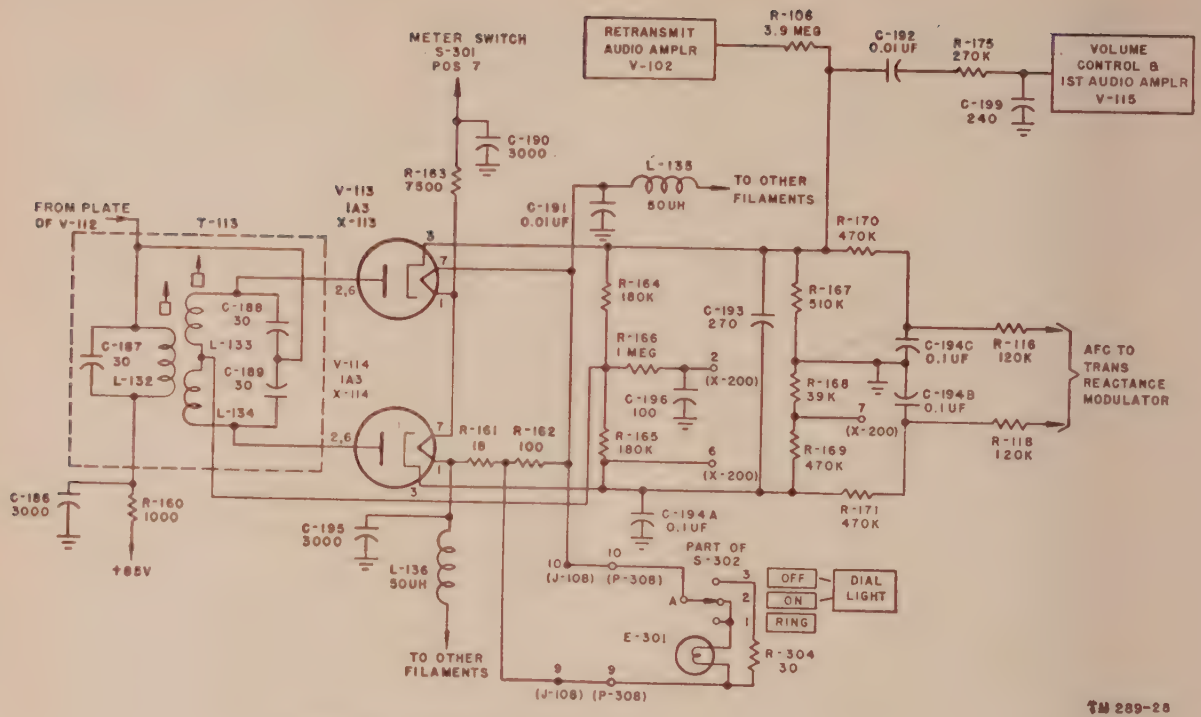


Figure 25. Receiver-discriminator circuit, functional diagram.

L–132 is in phase with the voltage at the plate of V–112. Since coils L–133 and L–134 are arranged in a series-aiding connection, the voltage induced in them from L–132 is positive at one end and negative at the other. The total voltage across L–133 and L–134 is equal to twice that across L–132. The voltages applied by induction to the plates of V–113 and V–114 are 180° out of phase with each other, and each is 90° out of phase with the voltage at the plate of V–112 and with the component of voltage applied by direct connection to the diode plate. The resultant voltages appearing across rectifier load resistors R–164 and R–165 thus are, at resonance, equal in magnitude and opposite in polarity. The net voltage across the output of the discriminator thus is equal to zero. This fact is measured across resistor R–168. Vector diagram A of figure 26 illustrates the phase relationships discussed above for the resonance condition. Vector OA is the voltage applied to each of the diode plates by direct connection (in-phase). OB and OC are the voltages applied by induction to the plates of V–113 and V–114, respectively, during one half-cycle of the signal voltage. During the second half-cycle, the polarity of the two vectors is reversed. OD and OE are the resultant voltages at the two diode plates.

(2) When the signal frequency deviates from the resonant frequency, the tuned circuits are no longer resistive and impart a reactive component to the voltages applied to the diode plates by induction. The component of voltage applied to the diode plates by direct connection remains unchanged with respect to the voltage appearing at the plate of V–112. The 90° phase relationship between the two components at each plate no longer holds. The amount of change in phase at the two diode plates is the same, but is opposite in sense. The resultant voltages applied across the rectifier diodes are no longer equal and opposite in polarity, and a net voltage is developed across the load resistors. For frequencies below resonance, the tuned circuits show an inductive reactance, and the inductively coupled component of voltage is shifted in

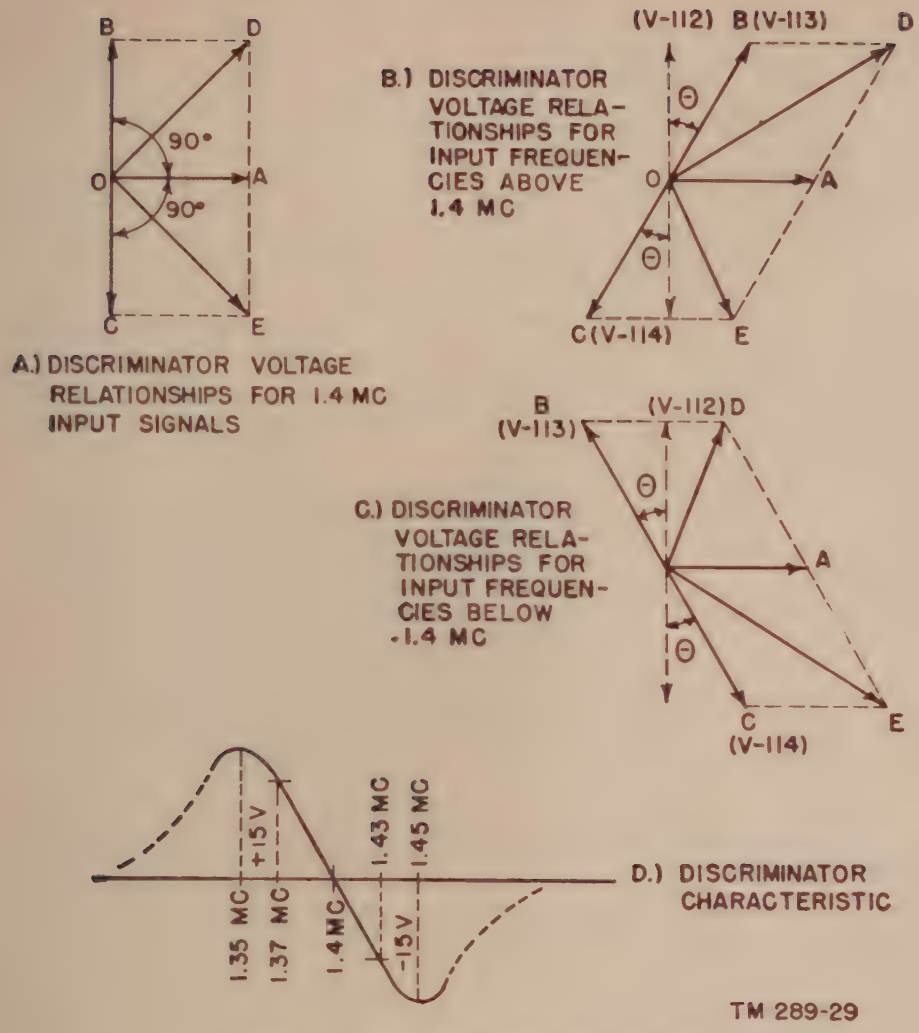


Figure 26. Discriminator theory, vector diagram.

phase in the leading direction. The larger resultant voltage then is applied to tube V–113. The output voltage across R–164 is larger than that across R–165, and the net output voltage of the discriminator is positive at the junction of pin 3 of V–113 and R–164. For frequencies above resonance, the tuned circuits show a capacitive reactance, the inductively coupled voltage is shifted in phase in the lagging direction, and the larger resultant voltage is applied to V–114. The rectified voltage across R–165 is larger than that across R–164, and the net voltage at the output of the discriminator is positive at the junction of R–165 and pin 3 of V–114. The phase relationships between the inductively coupled and directly coupled components of signal voltages for frequencies below and above resonance are shown in vector diagrams C and B, respectively, of figure 26. The vector designations are the same as those discussed above for diagram A. A typical response characteristic curve of the discriminator is shown in diagram D of figure 26.

(3) Since for a modulated signal the frequency shift above and below the resonant frequency occurs at the a-f rate, the changes in voltage across the two load resistors, R–164 and R–165, occur at the a-f rate. The resulting alternating voltage delivered to the following stages represents the audio fre-

quencies originally transmitted from the distant transmitter.

d. Discriminator Characteristics. An important point to be noted about the discriminator is that for proper operation the circuit must be balanced for both signal voltages and d-c current. Signal balance is maintained by adjusting the coils in the tuned circuit to be exactly equal to each other. D-c balance is maintained by keeping the load resistors, R–164 and R–165, exactly equal in value and, in addition, by making sure that the plate resistances of tubes V–113 and V–114 are approximately equal at all times. For a properly adjusted and operating discriminator circuit, the voltage measured at terminal 7 of X–200, when a 1.4-mc signal is applied to the input of V–112 (as measured at terminal 5 of X–200) is 0 ±.5 volt. For a signal, which is either 30 kc above or below the 1.4-mc center frequency, the voltage measured at pin 7 of X–200 should be ±15 volts minimum, depending on whether the higher or lower frequency is involved. The two voltages measured should be nearly equal to each other. Failure to obtain the 0 ±.5 reading indicates improper adjustment of the discriminator. If the two voltages for the two frequencies above and below 1.4 mc are not equal or nearly equal, then the discriminator is off balance. Normally, when a fixed component of the discriminator is defective, for example, capacitors C–188 and C–189, or resistors R–164 and R–165, balance in the discriminator suffers. Unbalance in the discriminator which is not caused by a defective component may be restored by adjustment of the powdered iron cores of L–133 and L–134. If the bandwidth is incorrect, that is, if the ±15-volt reading is not obtained, then adjustment of coil L–132, by means of the powdered iron core, is in order. It is assumed that the preceding tuned stages are properly alined and the oscillators are on frequency.

e. Measuring Points. The junction between resistors R–168 and R–169 is connected to pin 7 of test socket X–200. Measurement from this point to ground (terminal 1 of X–200) provides means for reading the output of the discriminator and for determining whether or not the tuned circuit is properly alined. Measurement of discriminator balance is made between terminals 6 and 2 of test socket X–200. Terminal 2 is connected through isolating resistor R–166 to the junction of load resistors R–164 and R–165. Terminal 6 is connected directly to the junction of resistor R–165 and the cathode of rectifier tube V–114.

f. Discriminator Output Circuits. The output of the discriminator is applied over several paths as follows:

(1) The output of the discriminator is coupled through capacitor C–192 and resistor R–175 to VOLUME control R–303, which is associated with the first audio amplifier, V–115 (par. 37).

(2) Through resistor R–106 and capacitor C–108 to the grid circuit of the retransmit audio amplifier V–102 (par. 39).

(3) An afc circuit is derived from the discriminator and connected to the transmitter reactance modulator for the purpose of maintaining the transmit oscillator on center frequency. The connecting paths are established through the audio filters consisting of resistors R–170 and R–116 and capacitor C–194C on one side, and resistors R–171 and R–118 and capacitor C–194B on the other side.

37. First Audio Amplifier V–115

(fig. 27)

a. The first audio amplifier stage uses a type 3Q4 pentode tube, V–115, in a Class A audio amplifier circuit with transformer output. The output of the discriminator is brought to the grid (pin 3) of V–115 through coupling capacitor C–192, low-pass filter R–175 and C–199, the VOLUME control, R–303, and the de-emphasis network, C–198 and C–197. The low-pass filter, R–175 and C–199, serves to block h-f noises from the input of the amplifier. De-emphasis network C–198 and C–197 serves to compensate the signal for the pre-emphasis imparted to it by the transmitter. The VOLUME control, located on the front panel, is connected into the circuit through pins 11 and 8 of chassis connectors P–307 and J–107.

b. The grid circuit includes the series arrangement of resistors R–173, R–174, R–109, and R–110. Resistor R–110 also serves as the load resistor for the squelch diode V–103 (par. 40). Resistor R–173 is in series or in shunt with the grid circuit, depending on whether the receiver-transmitter is in receiving and stand-by condition or in the transmit condition. Contacts 1 and 3 of relay O–101 are connected across this resistor. The armature (contact 2) of the relay is connected to the grid (pin 3) of V–115. When the relay is de-energized, contact pair 1 and 2 is closed and resistor R–173 is arranged in series with

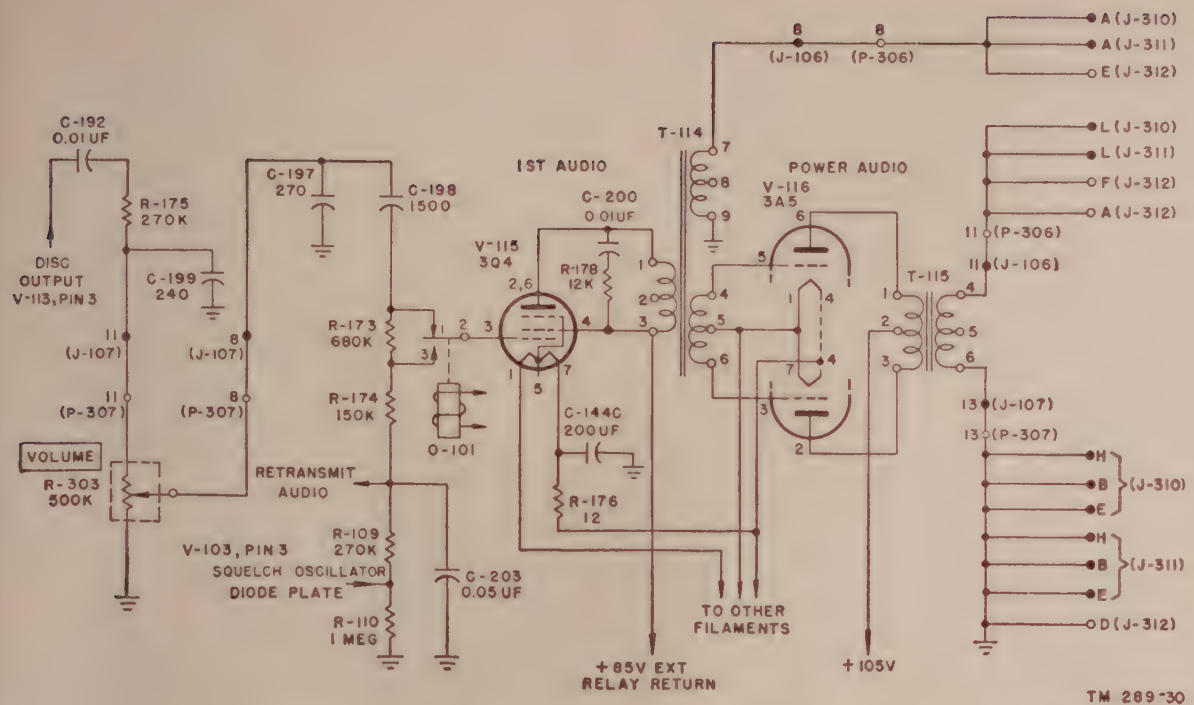


Figure 27. First audio amplifier and power audio amplifier circuits, functional diagram. In Receiver-Transmitter RT-66/GRC, change the value of R-110 to 510 K.

R–174, R–110, and R–109 in the grid circuit. The input level to the amplifier then is the normal received level. When relay O–101 is energized, that is, for transmission purposes, contacts 2 and 3 establish connection of the grid to the junction of R–173 and R–174; R–173 is then in series with the input circuit to the grid, thus acting as a voltage-dropping resistor. The signal applied to the first audio amplifier during transmission is the sidetone signal. The purpose of placing R–173 in series with the signal is to drop the sidetone level sufficiently to prevent acoustic feedback when monitoring in the receiver of a handset or loudspeaker.

c. The bias applied to the amplifier is a combination of the self-bias provided by the audio amplifier, which maintains it in the operating condition, and the bias developed across R–110 by the output of the diode in the squelch oscillator circuit. This bias voltage tends to drive the grid in the negative direction into the cut-off region. The operation of the squelch circuit is described in paragraph 40.

d. The amplified output is coupled through transformer T–114 over two paths. The signal voltage developed across winding 7–8–9 is applied through pins 8 of J–106 and P–306 to terminals A of the AUDIO connectors for use with a headset, or the earpiece of a handset, and to terminal E of the RECTR CONTROL connector. The signal voltage developed across winding 4–5–6 of T–114 is applied in push-pull to the grid circuits of power amplifier V–116.

e. Plate and screen voltages for V–115 (fig. 32) are obtained through terminals 5 of J–106 and P–306 to pins H of J–312 and J–309. The 85-volt supply is routed from B of J–309 through terminal 7 of J–106 and P–306, through resistor R–177 and terminal 2 of J–106 and P–306, back to terminals J of J–312 and J–309. When an external connection is placed between terminals H and J of J–312 or J–309, plate and screen voltages are applied to V–115. The connection between H and J of J–312 or J–309 may be a jumper strap, the contacts of an external relay, the coil of an external relay, or the contacts of a switch. The exact nature of the connection depends on the arrangement of the particular system in which the unit is used. It should be noted that no plate or screen voltage exists at the tube pins unless this connection is made. It also should be noted that if the coil of a relay is connected between these terminals, the relay will be energized when V–115

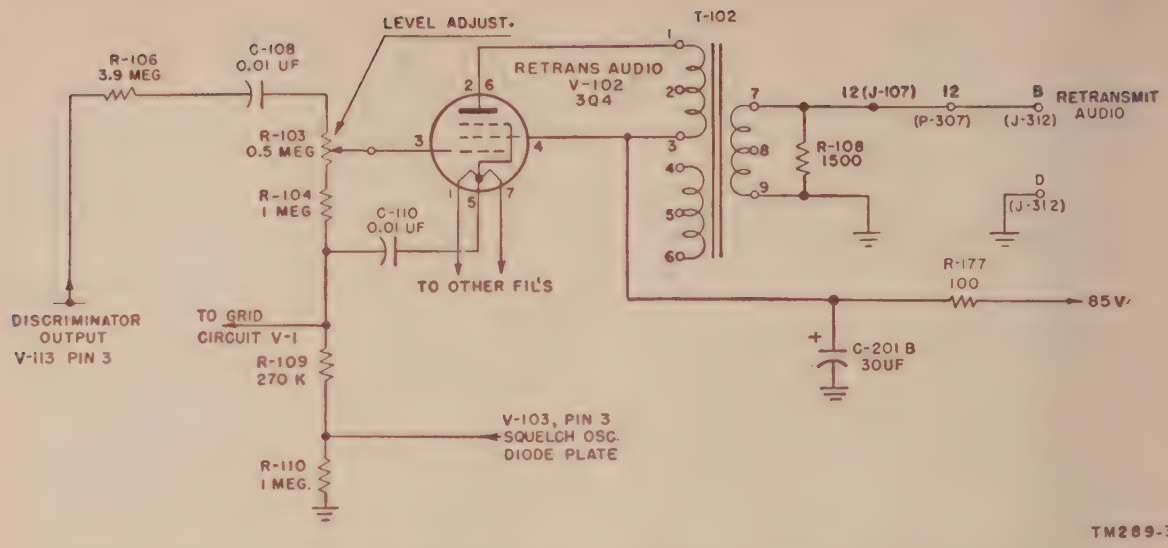


Figure 28. Retransmit audio amplifier, functional diagram. In Receiver-Transmitter RT-66/GRC, R-110 is 510K.

draws plate current and will be de-energized when V–115 plate current is cut off. The coil should not exceed 1,000-ohms resistance and should be shunted by a suitable capacitor. When the receiver is in the stand-by condition, and the squelch circuit cuts off the audio amplifier plate current, a relay thus connected will be de-energized. When an incoming signal cuts off the squelch circuit and V–115 plate current begins to flow, the external relay will become energized. This arrangement is used when the receiver-transmitter is used with accessory equipment requiring such control.

f. Capacitor C–200, in series with R–178, shunts the primary winding of T–114 to de-emphasize the h-f end of the audio band, and to reduce the noise voltages which may be present at that end of the audio band. Capacitor C–203 in the grid circuit bypasses squelch bias resistors R–110 and R–109 for audio signals.

38. Power Audio Amplifier V–116 (fig. 27)

a. The power audio amplifier stage uses a type 3A5 twin-triode tube, V–116, in a Class B push-pull amplifier. The signal voltage developed across the secondary winding (terminals 4–5–6) of inter-stage transformer T–114 is applied in push-pull to the grids (pins 3 and 5) of V–116. The amplified signals developed across the center-tapped primary winding of output transformer T–115 is induced in the secondary winding (terminals 4–5–6) of power output transformer T–115, and is routed through terminals 11 of J–106 and P–306 to terminals L of AUDIO connectors J–310 and J–311, and to terminals A and F or REC-TR CONTROL connector J–312, for connection to a loudspeaker.

b. Plate voltage for V–116 is applied to the center tap (terminal 2) of T–115 from the 105-volt tap on the associated power supply unit. This voltage is routed (fig. 32) from pin M of POWER IN connector J–309 through pins 3 of P–306 and J–106 to the center tap of the transformer.

39. Retransmit Audio Amplifier V–102 (fig. 28)

a. The retransmit audio amplifier V–102 uses a type 3Q4 pentode tube in a Class A audio amplifier circuit. Audio signals developed across the output of the discriminator circuit are routed through R–106 and C–108 to the level adjust control, R–103, the movable arm of which is connected to the grid (pin 3) of V–102. This control is factory adjusted and should not be touched unless the output of this stage does not meet the requirements in paragraph 65, item 2. The grid circuit includes screw driver adjustment potentiometer R–103, located on the i-f chassis, and resistors R–104, R–109, and R–110. Resistor R–110 also acts as the load for the squelch diode rectifier in the squelch oscillator circuit (par. 40). Under no-signal conditions, the rectifier diode of V–103 applies a voltage across R–110, the magnitude and polarity of which are such as to cut off

plate current flow in the retransmit audio amplifier V–102. This cut-off bias is removed when an incoming signal cuts off plate current in the squelch oscillator tube. Refer to paragraph 40 for squelch circuit details. The grid is returned to the filament center through bypass capacitor C–110. Resistor R–106 and capacitor C–108 serve as a noise filter and a decoupling circuit.

b. Plate and screen potentials are obtained from the 85-volt receiver supply by connection through a filter composed of resistor R–177 and capacitor C–201B to terminal B of J–309.

c. The output of V–102 is applied through winding 7–8–9 of T–102 and terminals 12 of J–107 and P–307 to terminal B of J–312. Load resistor R–108 across the secondary winding of T–102 serves to stabilize the effective output impedance of the amplifier for changes in external loading.

40. Squelch Circuit V–103

(fig. 29)

a. The squelch circuit uses a type 1S5 tube, V–103. The tube combines a pentode and diode in one envelope. The pentode is arranged to form a tuned-plate, tuned-grid oscillator. The diode rectifies the oscillator output. The purpose of this circuit is to keep the audio circuits at cut-off and the r-f amplifier at reduced gain during no-signal conditions of the receiver and to turn on the audio amplifiers and restore full gain to the r-f amplifier when a signal enters the receiver. Details of operation of the squelch circuit are described below.

b. The oscillator circuit includes the grid winding (terminals 3 and 4) and the plate winding (terminals 1 and 2) of L–108. No capacitor is shown connected across these two coils, since the tuning is accomplished by the interelectrode capacitance of the tube and the stray capacity in the wiring. The oscillator generates a frequency in the region of 30 kc. Regenerative feedback, to sustain oscillation, is established partially through leakage across the shield between the plate and grid windings of L–108 and partially through electron coupling within the tube. The grid circuit is returned to filament through grid resistor R–113 and is also connected through resistor R–111, bypassed by capacitor C–118, to the grid (pin 6) of the second limiter tube, V–112. Thus, any bias voltage developed in the grid circuit of V–112 is applied not only to V–112 but also as a bias to the grid of V–103. When no signal is present in the receiver, noise voltages are developed across the grid resistors of V–112. These voltages serve to bias the oscillator circuit V–103 to sustain oscillation. When a signal enters, the voltage across the grid resistors of V–112 is changed so that the oscillator circuit is driven to cut-off and oscillations cease.

c. The output of the oscillator is coupled through capacitor C–115 to the plate (pin 3) of the diode section of V–103. When the oscillator is operative, this signal is rectified by the diode circuit. The rectified voltage is developed across diode load resistor R–110. The return circuit for these voltages is established through ground and the filament (pin 1) of V–103.

d. The voltage developed across R–110 is applied over three paths to the r-f amplifier stage V–1 to the retransmit audio stage V–102 and to the first audio amplifier V–115. Diode load resistor R–110 is common to the grid circuits of V–1, V–102, and V–115. The grid circuit of V–102 extends through potentiometer R–103, resistors R–104 and R–109, and through diode load resistor R–110. The grid circuit of V–115 extends resistors R–173, R–174, and R–109, and diode load resistor R–110. Resistors R–109 and R–110 also are in parallel with resistors R–54 and R–55 in the grid circuit of V–1. The rectified oscillator voltage developed across R–110 therefore is effectively applied to all three tubes, namely V–102, V–115, and V–1, and serves to bias these tubes. This condition prevails as long as no signal enters the receiver and the squelch oscillator is operative. An on-frequency signal entering the receiver increases the bias of the second limiter V–112, and biases the squelch oscillator V–103 to cut-off. The rectified voltage disappears from across resistor R–110 and the bias is removed from V–1, V–102, and V–115. These tubes are returned to full operation.

e. Contacts 2–3 of relay 0–1 are shunted across resistors R–109 and R–110. During receiving and stand-by conditions when relay 0–1 is de-energized, the contacts of this relay normally are open. When the relays become energized for transmission purposes, these contacts close and place the junction of resistor R–109 and capacitor C–203 at ground potential, effectively removing any bias voltage applied from the squelch circuit to tubes V–1, V–102, and V–115.

f. Plate voltage for the oscillator section of V–103 is applied through resistor R–172, which is bypassed by C–144B, and through the secondary winding of coil L–108. Screen voltage is obtained from the

85-volt source through resistor R–301, potentiometer R–302, and switch S–303. Capacitor C–114 is the screen bypass capacitor. R–302 is the SQUELCH potentiometer on the front panel. This potentiometer and S–303 are assembled mechanically so that when the SQUELCH potentiometer is in the extreme counterclockwise position, the switch is open and removes screen voltage from V–103, thereby disabling the squelch circuit. Resistor R–301 drops the screen grid voltage to the required value. The level of the signal generated by V–103 is determined by the setting of R–302. When this potentiometer is in its maximum clockwise position, the full 85 volts is applied to the screen. The output level of the oscillator is high and the bias voltage across R–110 is relatively large. As R–302 is rotated in the counterclockwise direction, the applied screen voltage, the level of the generated oscillator output, and the bias voltage across R–110 are reduced accordingly. The lower the bias voltage across R–110, the lower the level of the signal and therefore the lower the grid bias required to disable the squelch circuit.

Resistor R–111 and resistors R–157 and R–158, in the grid circuit of V–112, form a voltage divider to set the voltage applied to the grid of V–103 to the required value. C–117 bypasses the grid circuit for rf. Filament voltage is applied through isolating coil L–107 which is bypassed by capacitor C–116.

g. Parts of the preceding subparagraphs are rewritten below to include the circuit differences encountered in Receiver-Transmitter RT–66/GRC.

(1) The oscillator circuit includes the grid winding (terminals 3 and 4) shunted by damping resistor R–179 and the plate winding (terminals 1 and 2) of L–108. Terminal 2 of L–108 is connected to the plate (pin 5) of V–103. Terminal 1 of L–108 is connected to resistor R–172, in the plate supply lead. No capacitor is shown connected across the two coils, since the tuning is accomplished by the interelectrode capacitance of the tube and the stray capacity in the wiring. The oscillator generates a frequency in the region of 30 kc.

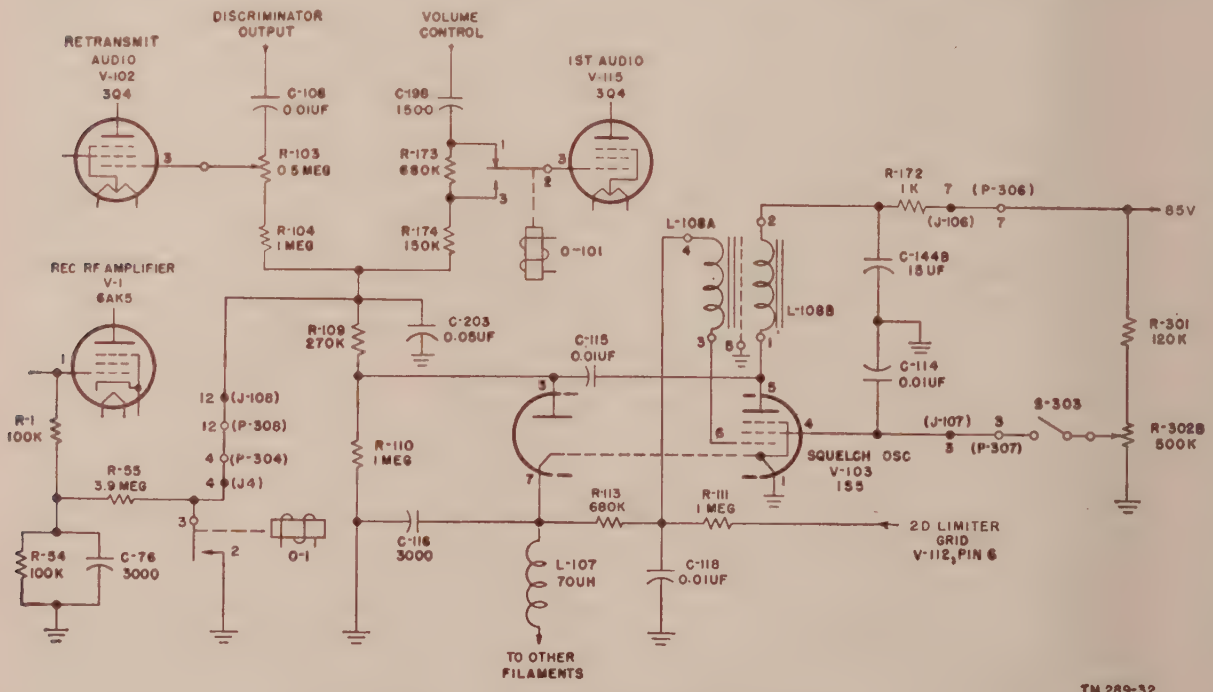


Figure 29. Squelch circuit, functional diagram.

Note. In Receiver-Transmitter RT–66/GRC, the following differences exist:

(1) Resistor R–110 is 510 K.

(2) Terminals 1 and 2 are interchanged on L–108 B.

(3) A capacitor, C–204 (5 $\mu\mu$f), is connected between terminals 5 and 6 of V–103

(4) A capacitor, C–205 (.01 μf), is connected between the junction of L–108B and R–172 to ground.

(5) A resistor, R–179 (180K), is connected between terminals 3 and 4 of L–108 A.

(6) Resistor R–113 is disconnected from pin 7 of V–103 and grounded. R–113 becomes 270 K.

(7) L–107 and C–116 are disconnected from pin 7 of V–103 and connected to pin 1. Pin 1 is removed from ground.

(8) Pin 7 of V–103 is connected to other filaments.

(9) R–55 is 2.2 megohms.

Regenerative feedback, to sustain oscillation, is established partially through electron coupling within the tube and partially through coupling capacitor C–204, which is connected between the plate and the grid of V–103. The plate circuit is returned to ground through grid resistor R–113 and also is connected through R–111, bypassed by capacitor C–118, to the grid of the first limiter tube V–111. Resistors R–111 and R–113 thus act as a voltage divider for the voltage developed in the grid circuit of V–111. Any bias voltage developed in the grid circuit of V–111 is applied not only to V–111, but also as a bias to the grid of V–103. When no signal is present in the receiver, noise voltages are developed across the grid resistors of V–111. These voltages serve to bias the oscillator circuit V–103 to sustain oscillations. When a signal enters, the voltage across the grid resistors of V–111 is changed so that the oscillator circuit is driven to cut-off and oscillations cease.

(2) The output of the oscillator is coupled through capacitor C–115 to the plate of the diode section of V–103. When the oscillator is operative, this signal is rectified by the diode circuit. The rectified voltage is developed across diode load resistor R–110. The return circuit for these voltages is established through ground and the string of filaments (which includes the filament of V–103), V–103, V–102, and V–107.

(3) An on-frequency signal entering the receiver increases the bias of the first limiter V–111 and biases the squelch oscillator V–103 to cut-off.

(4) Plate voltage for the oscillator section of V–103 is applied through resistor R–172, which is bypassed by ripple filter C–144B and r-f filter C–205, and through the secondary winding of coil L–108. Screen voltage is obtained from the 85-volt source through potentiometer R–302 and switch S–303.

(5) Resistor R–111 and resistors R–153 and R–154, in the grid circuit of V–111, form a voltage divider to set the voltage applied to the grid of V–103 to the required value. Filament voltage is applied through isolating coil L–107; connected to pin 1 of V–103. L–107 is bypassed by capacitor C–116. The other side of the filament, pin 7 of V–103, is connected to the filament, pin 1, of V–102.

41. Control Circuits

(fig. 30)

a. General. The push-to-talk function of the receiver-transmitter is performed by three relays, O–1, O–101, and O–301. These relays are mounted on the r-f chassis, i-f chassis, and on the back of the front panel, respectively. Relays O–1 and O–101 are inclosed in hermetically sealed cans. Relay O–301 is an open type. The coils of the three relays are all connected in parallel. One side extends to terminal A of J–309, which is the 5.6-volt relay supply connection to the power supply. The other side connects to terminals F of J–310 and J–311, K of J–312 and the DIAL LIGHT (ON-OFF)-RING switch. These are the ground return connections for the relay circuits. The terminals are connected in system wiring to external components (mounting, control boxes, etc.) that complete the circuit to ground through the grounded contacts of a push-to-talk switch of a microphone, or of a control relay, or of a control switch. Normally, these ground return connections are open, and the relays are not energized, maintaining the receiver-transmitter in the receiving condition. When the microphone push-to-talk switch, the control relay, or the control switch is operated, ground return is applied and the relays become energized. Resultant transfer of the relay contacts performs the following basic functions:

(1) The antenna is transferred from the receiver to the transmitter.

(2) The power supply connections are opened for certain portions of the receiver, and power supply connections are made to the transmitter circuits.

(3) The d-c and a-c paths to the microphone input circuits are established. The receiver audio circuits are switched for reduced output as required for sidetone.

(4) A control lead connection is established to energize the transmitter power supply.

b. Relay O–1. This relay performs the following functions:

(1) Contacts 4 and 5 connect the 250-volt lead (terminal F of J–309) to the screen of the power amplifier stage, V–11.

(2) Contacts 6 and 7 connect the 150-volt lead (terminal C of J-309) to plates and screens of the transmitter driver stage, V-9 and V-10.

(3) Contacts 2 and 3 short circuit the bias voltage developed by the squelch oscillator diode. This arrangement effectively disables the squelch circuit during transmit periods. It also prevents any bias voltage which may be developed in the grid cir-

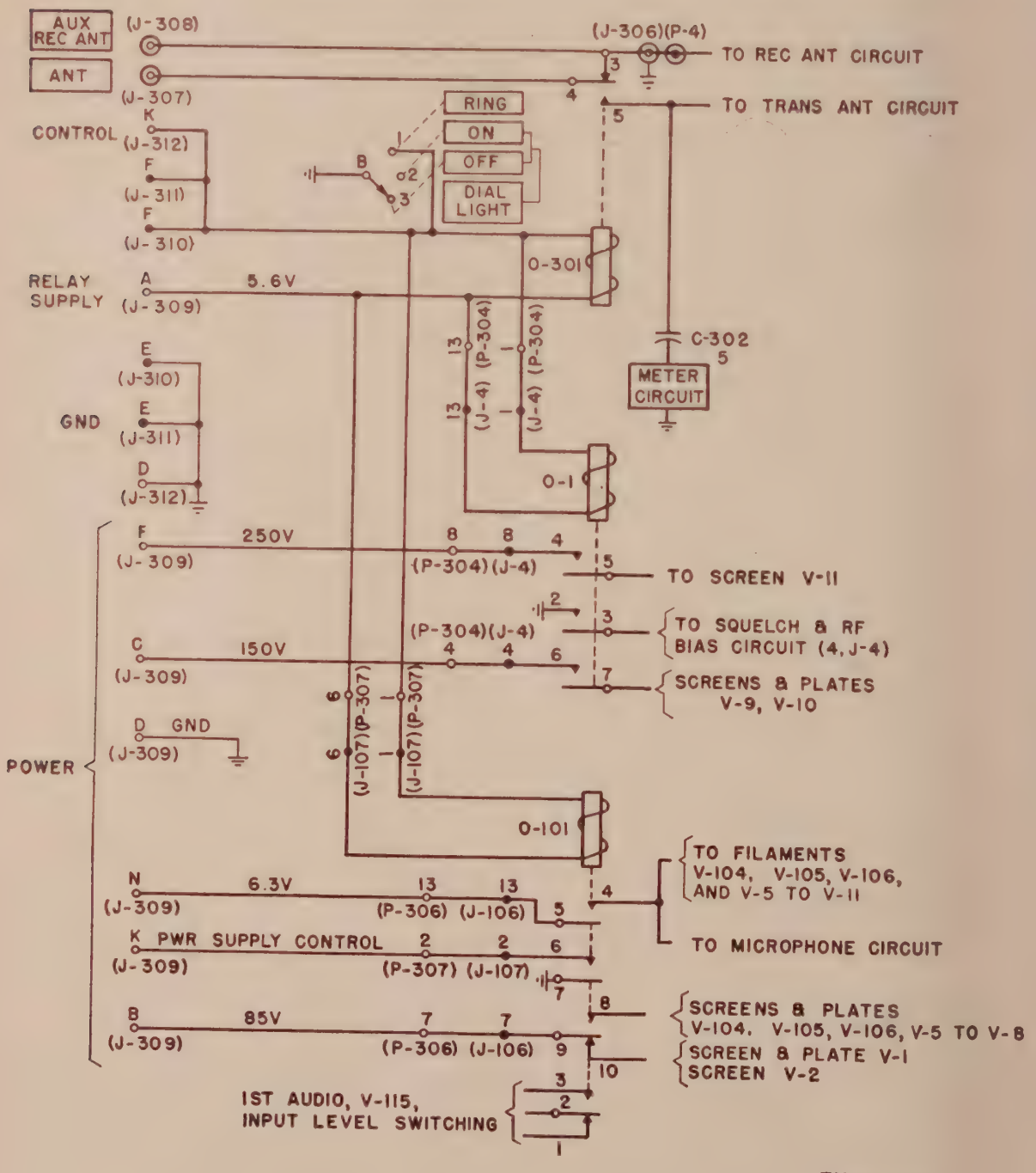


Figure 30. Control circuits, functional diagram.

cuit of V–1 during transmit periods from biasing the audio amplifier stages.

Note. The plate of V–11 is not switched by relay contacts in the receiver-transmitter, but is connected directly to the 450-volt supply lead (terminal P of J–309). However, no power is actually applied to any of the transmitter circuits (including the 450-volt circuits), until contacts 6 and 7 of relay O–101 apply ground to terminal K of J–312. This connection energizes a relay in Power Supply PP–109/GR or PP–112/GR, normally used to supply power to the receiver-transmitter. The power supply relay then becomes energized, and turns on the plate, screen, filament, microphone, and bias supply circuits. This arrangement insures that no power is applied to the transmitter circuits before the antenna load is connected, and that the high current drain transmitter supply circuits in the power supply are not energized before a load (the transmitter) is connected to them.

c. Relay O–101. This relay performs the following functions:

(1) Contacts 1, 2, and 3 serve to adjust the level of the audio output during the receive and transmit periods. During the receiving period, contacts 1 and 2 are closed, connecting the grid of the first audio amplifier tube V–115 to the junction of R–3 and C–198, thus applying the full signal voltage developed across the grid circuit of V–115 to the audio amplifier stages. During transmit periods, contacts 2 and 3 are closed, connecting the grid of V–115 to the junction of R–174 and R–173. These resistors then function as a voltage divider for reducing the level of the sidetone signal applied to the grid of V–115. This arrangement insures that the level of the sidetone reaching the earpiece of the handset or loudspeaker is not high enough to cause acoustic feedback to the microphone portion of the handset, and thus prevents the establishment of a singing circuit.

(2) Contacts 4 and 5 extend the 6.3-volt supply from terminal N of J–309 to the filaments of transmitter tubes V–104, V–105, V–106, and tubes V–5 through V–11.

(3) Contacts 6 and 7 apply ground return to the control relay in Power Supply PP–109/GR or PP–112/GR, through terminal K of J–309. The transmitter power supply circuits are not energized until this connection is made (*b* above).

(4) Contacts 9 and 10 open to remove B+ from the plate and screen of V–1 and from the screen of V–2. Contacts 8 and 9 close to connect the 85-volt supply lead from terminal B of J–309 to the plates and screens of V–104, V–105, and V–106.

d. Relay O–301. This relay switches the antenna from the receiver input circuits (contacts 4 and 3 open) to the transmitter output circuits (contacts 4 and 5 close).

42. Filament Circuits

(fig. 31)

a. The filaments of the tubes in the receiver-transmitter are arranged in two groups. One group includes all receiver filaments and those of the crystal oscillator-harmonic generator and first harmonic amplifier. These are energized by direct connection to the filament supply lead, terminal L of J–309. The other group includes all transmitter tube filaments (including the second harmonic amplifier) which are energized when contacts 4 and 5 of relay O–101 close (par. 41) and connect these filaments to the transmitter filament supply lead, terminal N of J–309. The filaments in each group are arranged in several 6.3-volt, series-parallel strings (fig. 31).

b. Voltage-dropping resistors (R–176, R–107, R–148 and R–194, R–10, R–124, R–122, and R–25) are inserted in series with those filament strings where the total voltage rating of the filaments in that string is below the supply voltage value of 6.3. Resistors (R–143, R–102, R–159, R–14, R–18, R–161 and R–162, R–9, R–123, R–34, R–44, R–35, and R–45) are shunted across the filaments in the string or where shunting of plate current is necessary. These shunt resistors serve to establish the filament current at the required value. Isolating chokes and filter capacitors are used throughout to prevent a-c current in one stage from entering tubes in the same or associated strings.

c. A measuring circuit, associated with each filament string (except those including V–11 and V–1), extends through a measuring resistor to a terminal on switch S–301. The receiver tube filaments are associated with positions 7 through 11 of that switch, while the transmitter tube filaments are checked in positions 2 through 6. When the switch is turned to any one of positions 2 through 11, the meter, in series with the measuring resistor, is connected between the approximate midpoint of the string and chassis. Since each filament string represents a voltage drop of 6.3 volts, the meter reading of 3

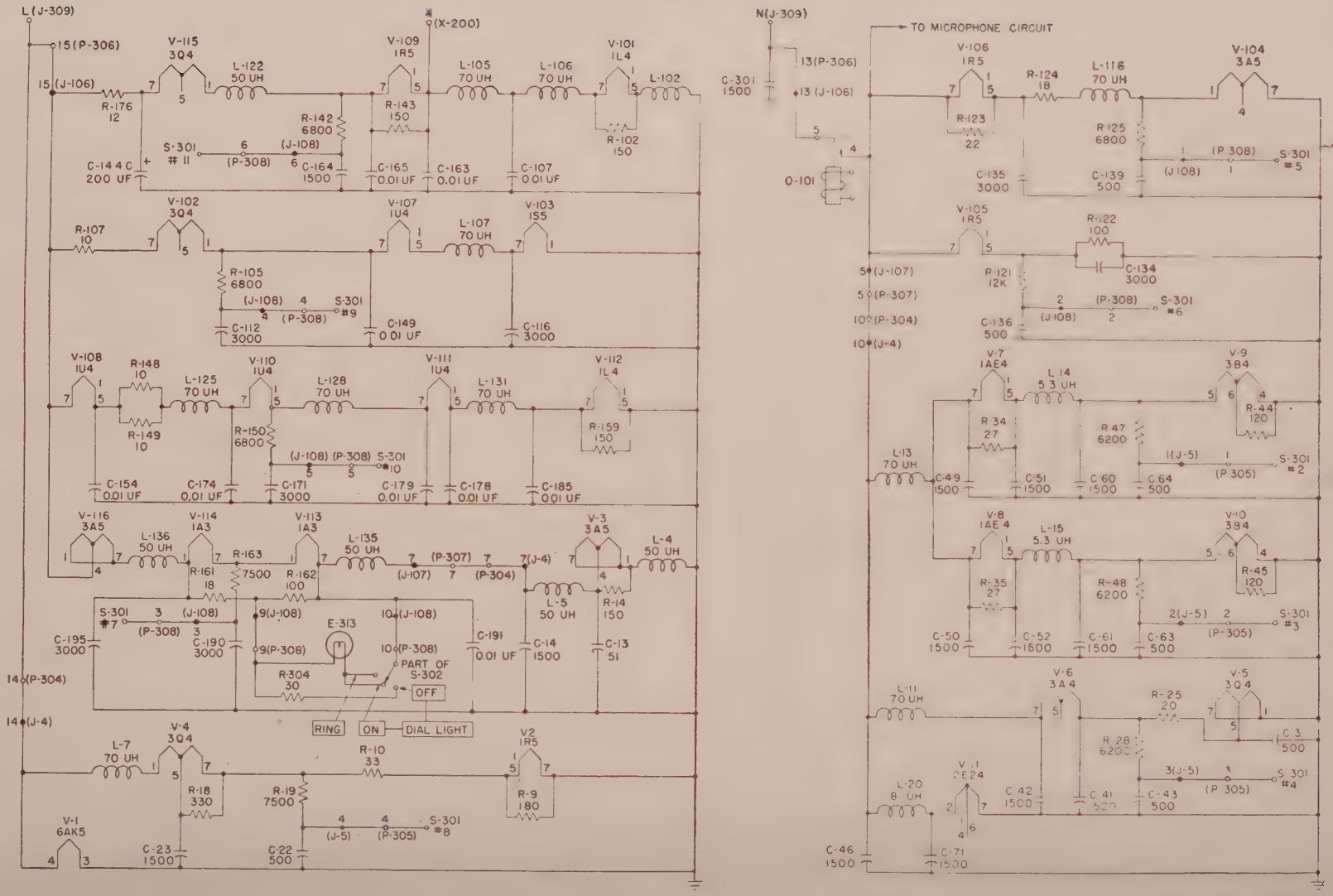


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Figure 31. Filament circuits, functional diagram. In Receiver-Transmitter RT-66/GRC, interchange the positions of V-107 and V-103 and reverse the pin connections of V-107. C-116 is connected to pin 1 of V-103.

volts (approximately) indicates that the filaments in the string are good. (The 3-volt point is indicated by a shaded area on the meter.) A broken filament in a string will cause a zero reading, a reading considerably less than 3 volts but not zero, a reading considerably more than 3 volts but not 6.3 volts, or a reading of 6.3 volts (full supply voltage), depending on the position relative to the test point which the faulty filament occupies. For example, an open filament on the ground side of the measuring point will cause a high-voltage reading. An open filament on the battery side of measuring will cause a low or zero reading. An open filament which is shunted by a resistor will cause a low or high reading (but not zero or full battery voltage), depending on its position in the string, since the resistance of the resistor alone is higher than that of the parallel arrangement of the resistor and the filament. If all receiver tube filament readings are high, it is an indication of an open filament on V–1. If all transmitter filament readings are high, it is an indication that the filament of V–11 is opened. The opening of either filament may cause the protection relay in the power supply to function and thereby cause all readings to be uniformly low instead of high.

d. The dial light, E–313, is associated through contacts of S–302 (in the DIAL LIGHT ON and RING positions) with the filaments of the discriminator tubes, V–113 and V–114. Resistors R–161 and R–162, connected across the filaments of these tubes, serve the additional purpose of dropping the voltage to the value required by the dial light. When S–302 is in either the DIAL LIGHT ON or the RING position, E–313 is connected across R–162, and the voltage drop across this resistor causes the light to go on. When S–302 is in the DIAL LIGHT OFF position, E–303 is disconnected, and an equivalent resistor R–304 is connected in its place to maintain the resistance of the filament string constant, regardless of the position of S–302.

43. Plate Supply Circuits

(fig. 32. *See insert in back of manual*)

a. Receiver Supply Circuits. All receiver tubes, including crystal oscillator-harmonic generator, first harmonic amplifier tubes V–3 and V–4, obtain their plate and screen potentials by direct connection to the 85-volt supply lead, terminal B of J–309, except as follows:

(1) Screen voltage for squelch oscillator V–103 is applied through SQUELCH potentiometer R–302B and contacts of squelch switch S–303. Adjustment of R–302B varies the screen voltages of V–103, and serves to vary the output level of the squelch oscillator. S–303 is opened when R–302B is in the extreme counterclockwise position, disconnecting screen voltage from V–103 and disabling the squelch circuit.

(2) Plate voltage for V–2 is routed through interchassis coaxial cable connectors J–101 and P–1, which link the plate of V–2 (on the r-f chassis) with the plate circuit components located on the i-f chassis.

(3) Plate and screen voltages for V–1 and screen voltage of V–2 are routed from terminal B of J–309 over normally closed contacts 9 and 10 of relay O–101. When this relay is unenergized, the contacts are closed and V–1 and V–2 are energized. When relay O–101 is energized, contacts 9 and 10 open and these voltages are removed.

(4) Power audio amplifier tube V–116 obtains its plate potentials by direct connection to the 105-volt supply lead, terminal M of J–309.

(5) Plate and screen voltage for V–115 is applied when an external connection is placed between terminals J and H of J–312 or J–309. Terminal J of J–312 connects internally to B of J–309 (the 85-volt supply terminal), while H of J–312 connects to the plate and screen of V–115. There is no internal connection between the plate and screen of V–115 and the supply lead. The purpose of this arrangement is to permit adapting the receiver-transmitter for use in a retransmit circuit where an external device is required to be controlled by a received signal. When this type of control is necessary the coil of an external relay and bypass capacitor are placed between H and J of J–312 or J–309. When the receiver is in stand-by position, the external relay is unenergized, since the squelch circuit keeps the plate current of V–115 at cut-off. When a signal enters the receiver, or when the SQUELCH switch, S–303, is opened, plate current flow in V–115 energizes this relay which in turn functions to complete circuits in associate equipment.

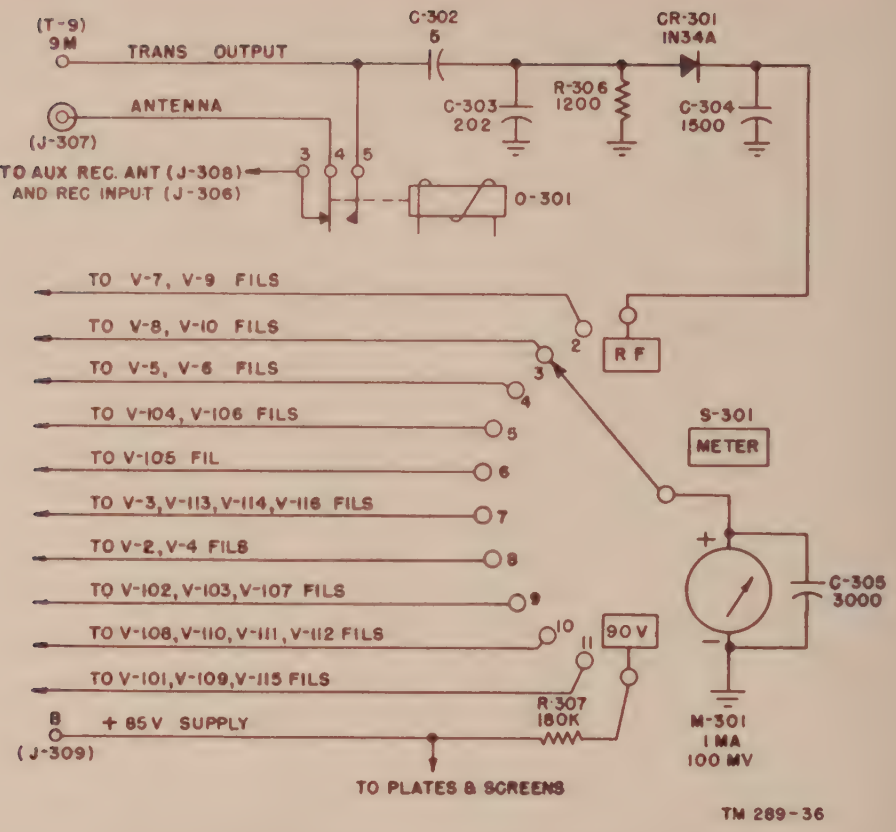


Figure 33. Measuring circuit, functional diagram. In Receiver-Transmitter RT-66/GRC, C-303 is 470 μμf.

b. Transmitter Supply Circuits. (fig. 32). The plates and screens of all transmitter tubes, except V–3 and V–4, are energized only when relays O–101 and O–1 are operated (par. 41).

(1) All transmitter tubes, except the transmitter driver (V–9 and V–10), transmitter power amplifier (V–11), and ringer tube V–104B are energized from the 85-volt supply when relay O–101 becomes energized and closes contacts 8 and 9. When this occurs, the 85-volt supply lead (terminal B of J–309, is transferred from the plate of V–1 and the screens of V–1 and V–2 to the plates and screens of V–5 through V–8, V–105, and V–106, and the plate of V–104. The plate circuit of V–104B (ringer oscillator) includes the RING position of S–302. Thus, plate voltage for V–104B is applied only when S–302 is in the RING position. Other contacts of S–302 in the RING position energize relays O–1, O–101, and O–301 (par. 41).

(2) The plate and screen circuits of V–9 and V–10 extend through the normally open contacts (6 and 7) of relay O–1 to the 150-volt supply lead, terminal C of J–309.

(3) The screen circuit of V–11 extends through normally open contacts 4 and 5 of relay O–1 to the 250-volt supply lead, terminal F of J–309.

(4) The plate circuit of V–11 extends through plate coils L–22 and L–21, and measuring resistor R–35 to the 450-volt supply lead, terminal P of J–309 (par. 41).

44. Measuring Circuit

(fig. 33)

a. The measuring circuit includes a 1-ma 100-millivolt d-c meter M–301, a 12-position test switch S–301, and a half-wave rectifier circuit. The meter dial is not calibrated. However, a shaded area on the dial face indicates the range of correct readings for all switch positions except the RF position.

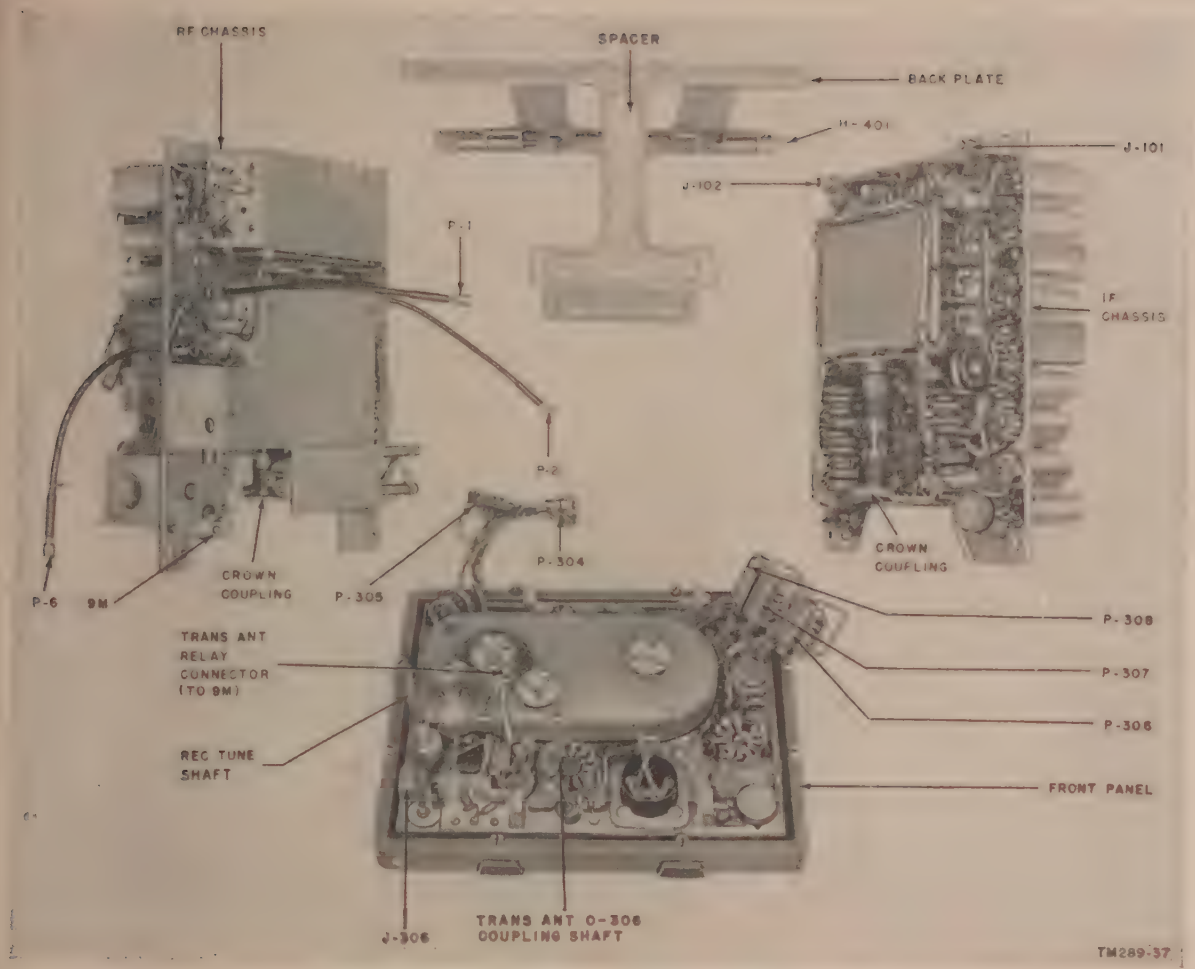


Figure 34. Typical receiver-transmitter, disassembled view.

b. Positions 2 through 11 of S–301 connect the meter between the filament circuit measuring resistors (par. 42) and chassis. The series arrangement of the meter and the measuring resistor, is placed across the filament circuits for determining whether or not the tube filaments are broken. The measuring resistor extends the meter range for the particular measurement. Positions 2 through 6 check all transmitter tube filaments, except that of V–11. Positions 7 through 11 check all receiver tube filaments, except V–1 (par. 42*c*). These two tubes can be checked by visual inspection.

c. Position 12 (marked 90V on the panel) arranges the meter, in series with voltage-dropping resistor R–307, across the 85-volt supply circuit (terminal B of J–309 and chassis). Thus, in this position, the meter checks the presence of 85-volt plate supply at the receiver-transmitter power input terminals.

d. Position 1 (marked RF on the panel) connects the meter across the output of the rectifier circuit for the purpose of determining the presence of transmitter power output. The rectifier circuit in turn is connected through capacitor C–302 across the tuned transmitter antenna circuit, C–74 and L–23. A type IN34A germanium crystal diode is used as a half-wave rectifier. Resistor R–306 is the diode load, and also limits the current through the rectifier and the meter. C–302 decouples the meter circuit from the antenna circuit, thus preventing detuning. C–303 and C–304 are r-f filter capacitors. The signal voltage developed across the antenna circuit is rectified and filtered, and applied as d-c potential across the meter. The proportionality factor is such that with

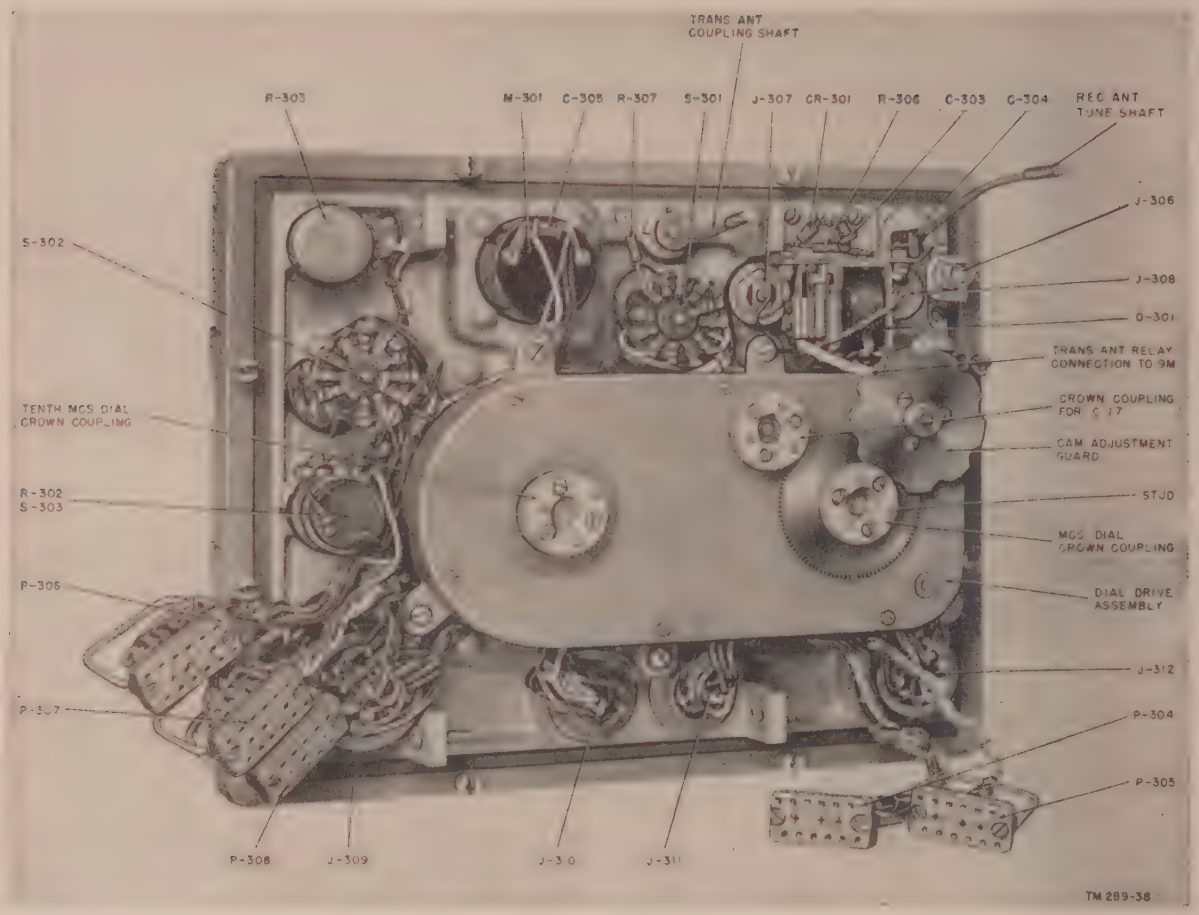


Figure 35. Rear view of panel.

proper antenna loading a half-scale reading on the meter corresponds to 15 watts of r-f power across the antenna circuit.

45. System Wiring

In addition to the circuits described in the preceding paragraphs, the receiver-transmitter provides parallel wiring at panel connectors. This wiring makes it possible to interconnect the signal, power, and control circuits of the receiver-transmitter with associated components, in different combinations required by the different types of systems in which the unit may be used.

a. Three parallel positions are provided at which the basic functions of the receiver-transmitter (talking, listening, and push-to-talk) may be accomplished. These are panel connectors J–310, J–311, and J–312. Thus, the microphone input connection is paralleled between terminals C of the three connectors. The phone connection is paralleled between terminals A of J–310 and J–311 and terminal E of J–312. The speaker connection is paralleled between terminals L of J–310 and J–311, and terminals A and F of J–312. Finally, the control (relay ground return) connection is paralleled between terminals F of J–310 and J–311, and terminal K of J–312. Microphone input, receiver output, and relay control connections can be made at any one, two, or three of these positions. The selection of the particular connector or connectors used is determined by the particular system arrangement, and is described in the technical manuals for the different systems.

b. Plate power connection for V–115 is provided (par. 41) by external connection of a strap, the normally closed contacts of a relay, or the coil of a relay between terminals H and J of J–312. These connections are paralleled in POWER IN connector J–309, terminals H and J. In vehicular installations, the connection between H and J on J–312 normally

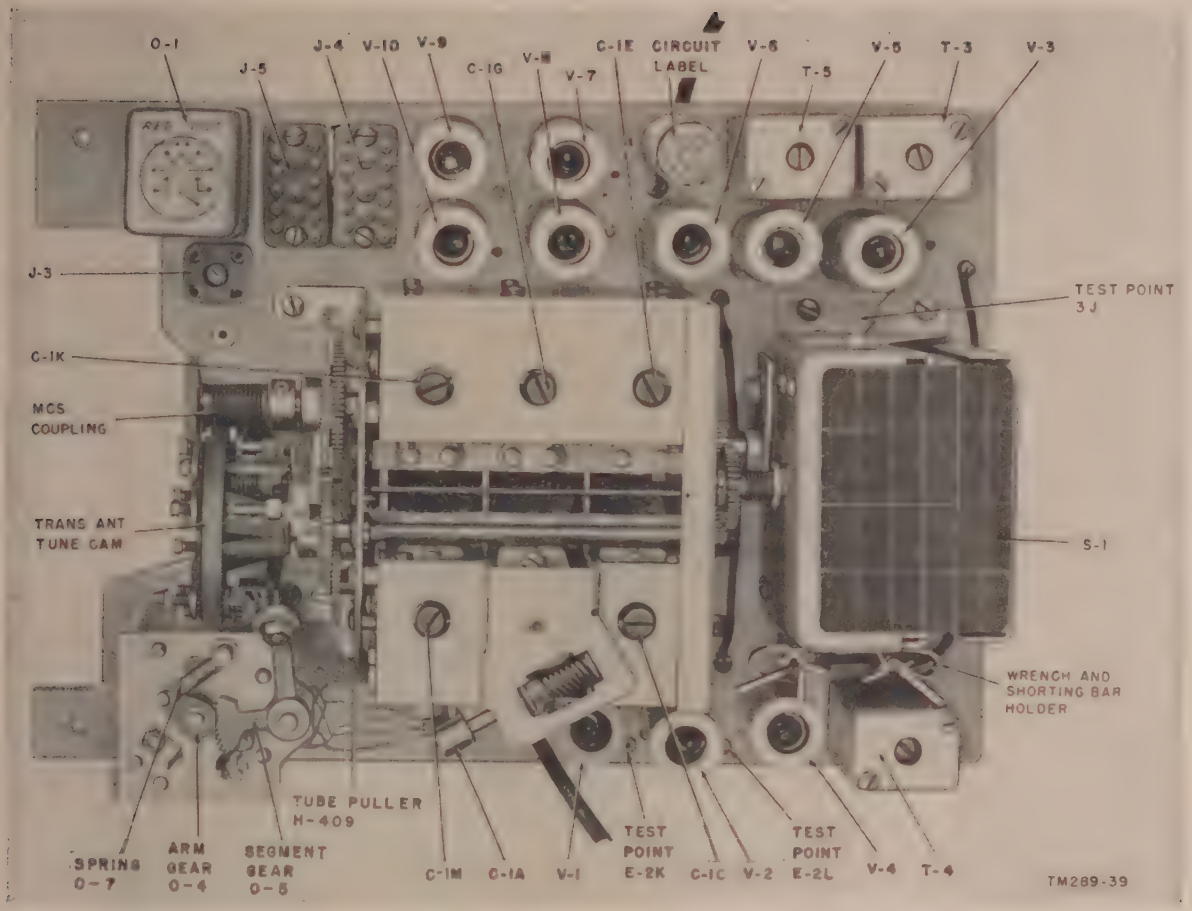


Figure 36. R-f chassis, component side.

is made through the mounting. In portable or emergency arrangements involving the use of dry batteries (Case CY–590/GRC) and a hand generator (Generator G–8/GRC), the strap connection is placed between H and J of J–309 by wiring in Power Cable Assembly CX–1210/U, which joins J–309 to Case CY–590/GRC and to the hand generator. The cable, battery box, and the hand generator are supplied as part of Modification Kit MX–898/GR.

c. For the connections and operation of a particular radio set, refer to the technical manual for that set.

46. Differences in Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC

Receiver-Transmitter RT–66/GRC and RT–67/GRC are similar to Receiver-Transmitter RT–68/GRC, described in paragraphs 18 through 45. They differ from that unit only in operating frequency range and in those circuit components which determine frequency range. These differences are summarized below.

a. Frequency Range. The operating frequency range of Receiver-Transmitter RT–66/GRC is between 20 and 27.9 mc. There are 80 channels of 100 kc each. Receiver-Transmitter RT–67/GRC is between 27 and 38.9 mc. There are 120 channels of 100 kc each. Receiver-Transmitter RT–68/GRC is between 38.0 and 54.9 mc. There are 170 channels of 100 kc each.

b. Tuning Arrangement. In Receiver-Transmitter RT–66/GRC, the MCS dial-drive mechanism includes 8 detent positions. Dial calibration plate shows numbers from 20 to 27. The TR ANT TUNE cam has cam-adjusting screws. In Receiver-Transmitter RT–67/GRC, the MCS dial drive mechanism includes 12 detent positions. Dial calibration plate numbers range from 27 to 38. The TR

ANT TUNE cam has 13 cam adjusting screws. In Receiver-Transmitter RT-68 GRC the MCS dial drive mechanism includes 17 detent positions. Dial calibration plate numbers range from 38 to 54. The TR ANT TUNE cam has 17 cam-adjusting screws.

c. Crystal Oscillator V–103. There is a dif-

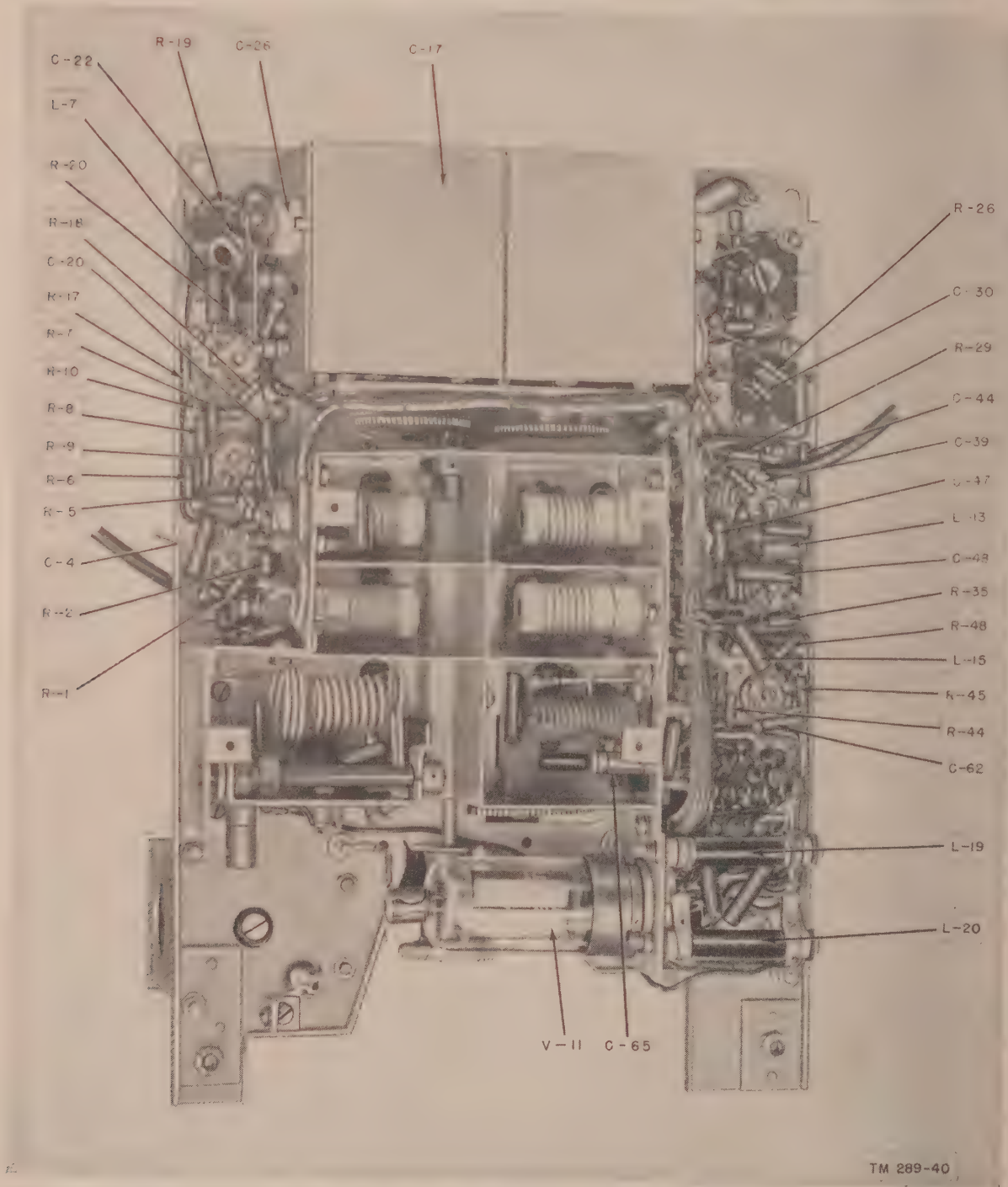


Figure 37. R-f chassis, wiring side, oblique view of top edge. In Receiver-Transmitter RT-66/GRC, R-2, C-4, and L-19 do not appear.

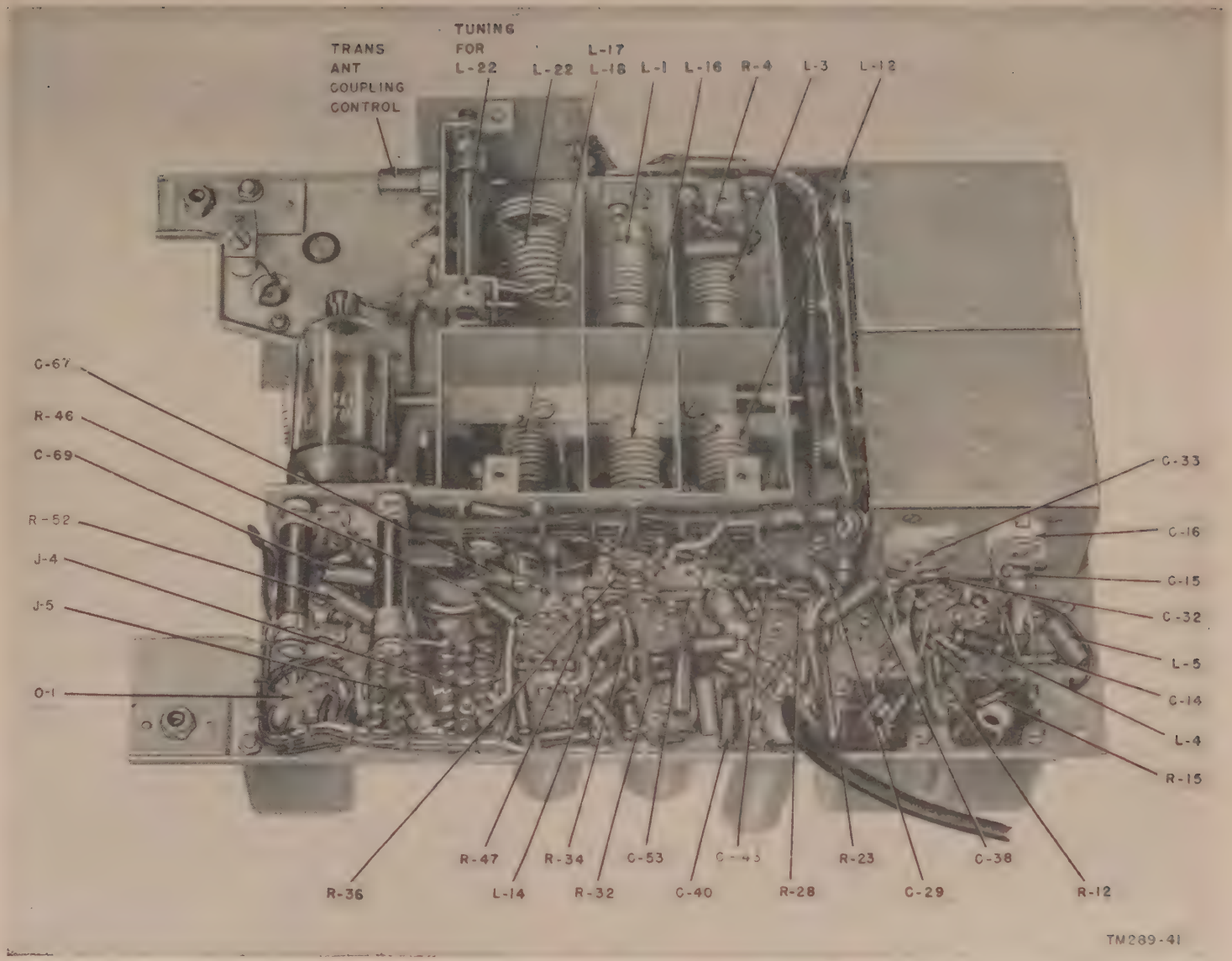


Figure 38. R-f chassis, wiring side, oblique view of bottom edge. In Receiver-Transmitter RT-66/GRC, C-69 does not appear.

ferent number of crystals for each receiver-transmitter (table I). The gears to the crystal switch are different for each set.

d. Harmonic Generator V–103 (Pins 5, 6, and 7). Shunt padder capacitor C–18, in the plate circuit (pin 6), is omitted in Receiver-Transmitter RT–66/GRC.

e. First Harmonic Amplifier V–4. Padder

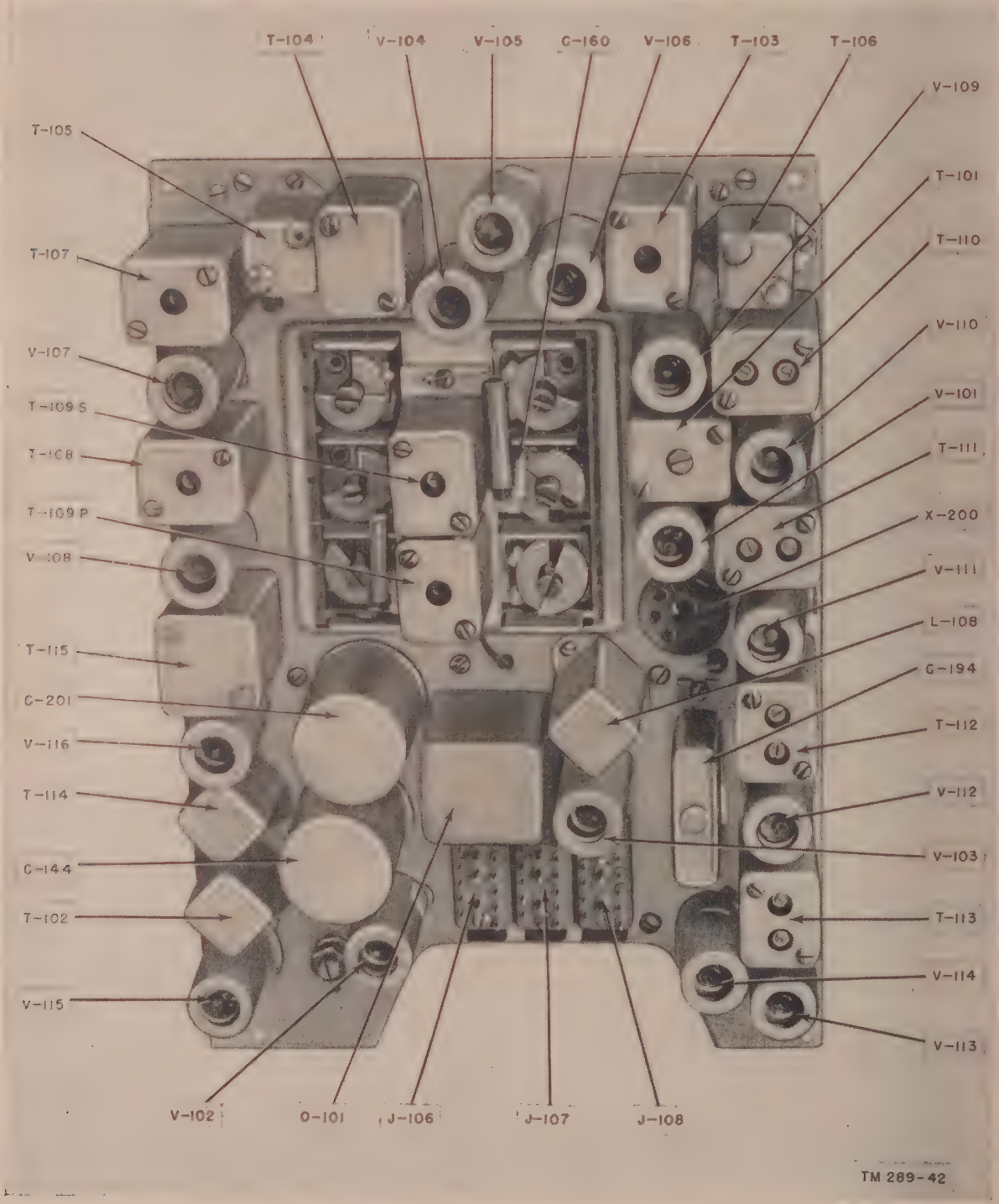


Figure 39. I-f chassis, component side.

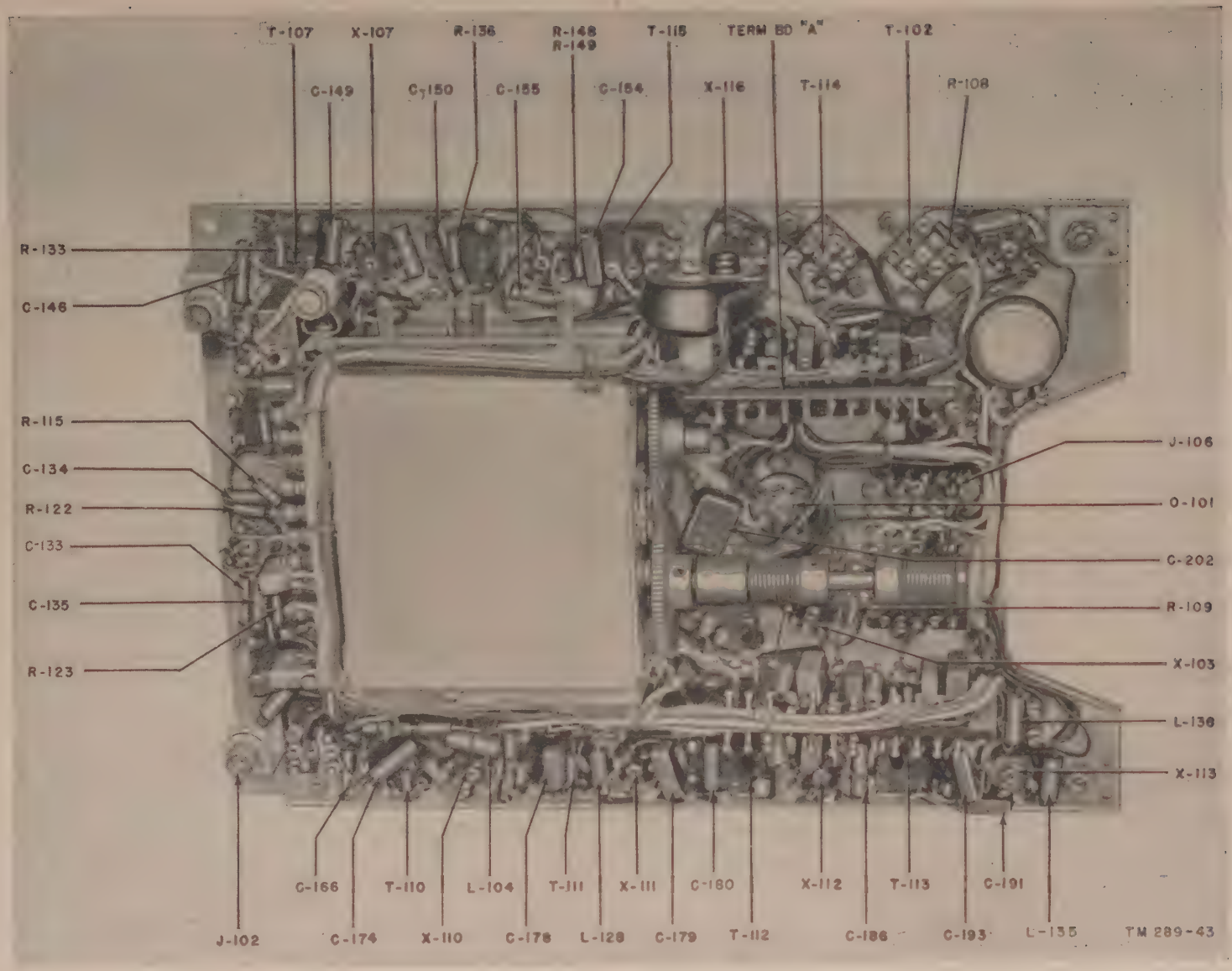


Figure 40. I-f chassis, wiring side, oblique view of top edge

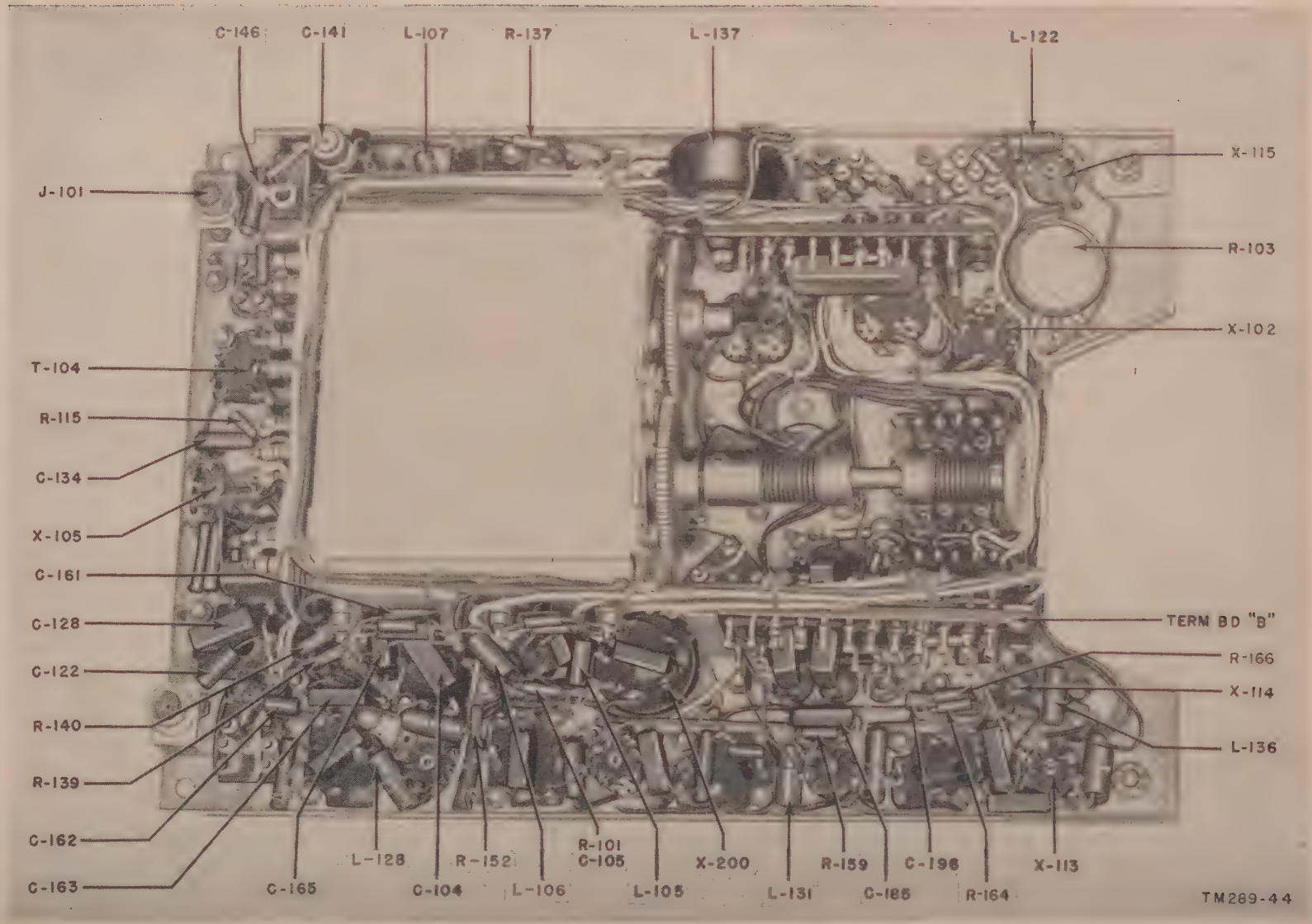


Figure 41. I-f chassis, wiring side, oblique view of bottom edge.

capacitor C–27 is omitted and variable capacitor section C–17B is connected directly to ground in Receiver-Transmitters RT–66/GRC and RT–67/GRC. Resistor R–20 is omitted in the plate circuit (pin 2) of V–4 for Receiver-Transmitter RT–68/GRC and has a value of 150 ohms in Receiver-Transmitter RT–66/GRC and 68 ohms in Receiver-Transmitter RT–67/GRC. The value of capacitor C–25 differs in all these sets.

f. Second Harmonic Amplifier V–5. Padder capacitor C–34 is omitted and tuning capacitor C–17C is returned directly to chassis in Receiver-Transmitters RT–66/GRC and RT–67/GRC. The value of padder C–35 differs in all three sets. Resistor R–24 is omitted in plate circuits of V–5 for Receiver-Transmitter RT–68/GRC and has a value of 150 ohms in Receiver-Transmitter RT–66/GRC and 100 ohms in Receiver-Transmitter RT–67/GRC. Capacitor C–34 is used only in Receiver-Transmitter RT–68/GRC. The neutralizing circuit, C–37 and L–10 in T–5, is omitted in Receiver-Transmitters RT–66/GRC and RT–67/GRC since the effect of stray capacity is not as great at the lower frequencies used by this unit.

g. Antenna Circuit. The value of TR ANT TUNE capacitor C–74 differs in all three sets. Capacitor C–75 is used only in Receiver-Transmitter RT–67/GRC.

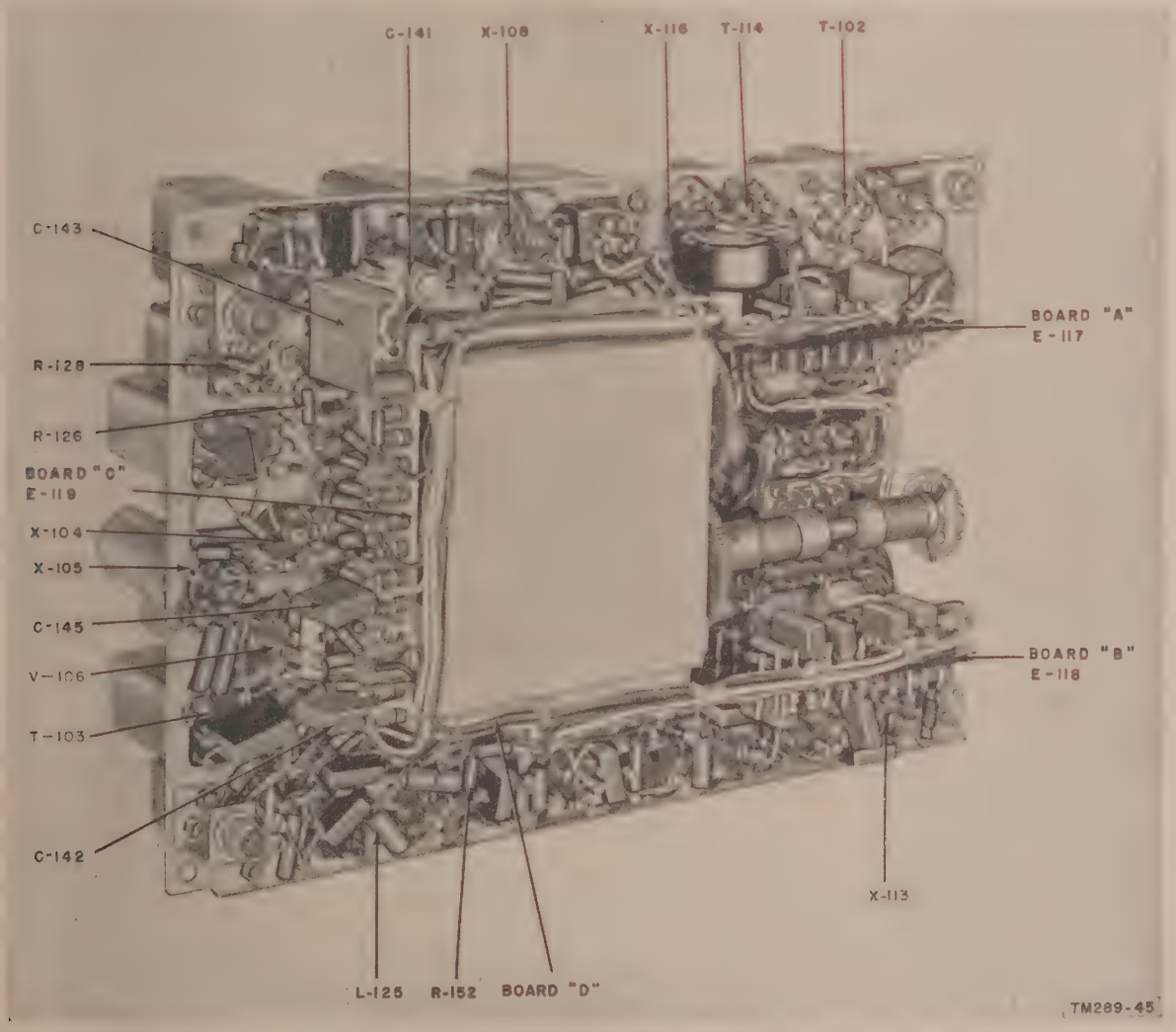


Figure 42. I-f chassis, wiring side, oblique view of rear edge.

CHAPTER 3

FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance personnel. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLE-SHOOTING AT FIELD MAINTENANCE LEVEL

47. Trouble-Shooting Procedures

The test procedures for sectionalizing and localizing trouble in Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC are outlined in the following steps:

a. Short-Circuit Checks. These checks consist of resistance measurements. They are intended to locate any short circuits which might damage the power supply or cause additional damage to the equipment when power is applied (par. 49). Repair all short circuits before applying power to the unit.

b. Operational Checks. The operational checks, outlined in chart form in paragraph 52, are made to determine whether or not the receiver-transmitter performs its various functions properly. The trouble symptoms thus obtained will point to a faulty condition within the transmitter or within the receiver and, in some cases, may sectionalize the trouble to a smaller circuit group. In some cases, a specific part or wire may be indicated as causing trouble. It is recommended that the operational checks be made in the order given, and that each trouble be cleared as it is found, before proceeding with that next operational check. Accordingly, every time a faulty condition is encountered, the additional checks recommended in the chart should be made. Detailed instructions for using the operational check chart are given in paragraph 51.

c. Additional Trouble Sectionalization Checks. A group of four trouble sectionalization charts (pars. 53 through 56) supplement the operational checks. These are the receiver, transmitter, tracking, and filament circuit check charts. When trouble is encountered as a result of an operational check, refer to the indicated chart and perform the additional checks called for. These checks will narrow the trouble possibilities down to a related group of stages and, in some cases, to an individual stage or part. A brief description of the charts follows.

(1) *Receiver trouble sectionalization chart (par. 53).* After trouble has been traced by operational checks to the receiver circuit, the tests indicated in the receiver trouble sectionalization chart will reduce the trouble to a circuit group, that is, audio circuit, variable i.f., fixed i.f., etc.

(2) *Transmitter trouble sectionalization chart (par. 54).* In a similar manner, this chart gives a series of checks for functionally grouped transmitter circuits. The internal checks indicated there will make it possible to limit the trouble to a particular transmitter stage.

(3) *Receiver-transmitter tracking check chart (par. 55).* This chart supplements the receiver and transmitter trouble sectionalization charts. It expands certain tests shown there to make it possible to localize tracking and difficulties due to mistuning to more or less specific causes.

(4) *Filament circuit check chart (par. 56).* The filament circuits of all tubes, except tubes V–1 and V–11, can be checked by means of the panel-mounted meter and METER switch S–301. Proper interpretation of the readings obtained by means of that switch and the meter will limit the fault to a particular tube or to a circuit element in the filament circuit. The filament circuit check chart facilitates making such an analysis.

d. Signal Substitution. Once the trouble within the receiver-transmitter has been sectionalized to a particular circuit, a signal substitution or signal tracing procedure (par. 57) is used to localize the trouble to a particular stage within the group of stages. A stage gain chart (par. 57*e*) is given to assist in making the signal substitution tests.

e. Resistance Measurements. These tests are made to locate faults or defective components and

wiring within the circuit or stage shown to be defective by the signal tracing procedure (par. 58).

f. Voltage Measurements. Voltage measurements (par. 59) are made to determine whether the correct d-c voltages are present at significant points of the circuit. They are made for the purpose of disclosing faults not observable during the preceding tests.

g. Additional Checks. Continuity checks (par. 60) are made to determine faults in wiring and circuit sections which cannot be discovered by any of the means outlined above.

48. Test Equipment and Tools Required for Trouble-Shooting

The following test equipment and tools are required for making the trouble-shooting tests described in this section. Arbitrary references are assigned to signal generators and meters listed below to facilitate identification with instruments called for in trouble-shooting procedures.

a. Either of the following power supply combinations:
- (1) A 12-volt storage battery and Power Supply PP–109/GR.
- (2) A 24-volt storage battery and Power Supply PP–112/GR.

b. Audio devices as follows:
- (1) Handset H–33/PT.
- (2) Microphone T–17: with cord and plug and Headset HS–30.

c. Loudspeaker LS–7: with cord and suitable connector.

d. Test instruments, as follows:
- (1) Electronic Multimeter TS–505/U: d-c voltohmmeter (M–1).
- (2) Electronic Multimeter ME–6/U or Multimeter TS–352/U: a-c voltmeter (M–2).
- (3) Output Meter TS–585/U or equal (M–3).
- (4) Frequency Meter Set SCR–211 (M–4).
- (5) Frequency Meter TS–174/U (M–5).

e. Signal generators, as follows:
- (1) Signal Generator set AN/URM–27 (G–1).
- (2) Signal Generator I–208, FM (G–2).
- (3) Audio Oscillator TS–382/U (G–3).
- (4) Signal Generator SG–20/U (G–4).
- (5) Signal Generator TS–588/U (G–5).

f. Electrical components, as follows:
- (1) Shunting unit, consisting of capacitor: .006 μf, in series with resistor; 2,700 ohms; ½ watt, complete with test clips.
- (2) Capacitor: mica dielectric; .006 μf.
- (3) Alligator type test clips (2 required).

g. Antenna components, as follows:
- (1) Dummy antenna, consisting of a 40-ohm, 100-watt, non-inductive type resistor assembly, in series with an r-f ammeter (Weston model No. 425 or equal), or see figure 44.
- (2) Antenna base and mast sections of type to be used with the receiver-transmitter (par. 8*a* (4)).

h. Cables and connectors, as follows:
- (1) Four-inch lead with alligator clips on each end (2 required).
- (2) Battery clips.
- (3) Connector, plug to mate with J–1 on Power Supply PP–109/GR or PP–112/GR.
- (4) Connector, plug to mate with J–106 (3 required).
- (5) Connector, receptacle to mate with P/306 (3 required), and wire, Signal Corps stock No. 5F1B1320.1 (135 feet required).
- (6) Connector, receptacle to mate with J–309 (3 required), and wire, Signal Corps stock No. 1B1316.1 (10 feet) and No. 1131320.9 (30 feet) or Power Cable Assembly CX–1210/U shorting together pins B and M on J–309 POWER IN connector on the receiver-transmitter.

i. Tools, as follows:
- (1) Tool Equipment TE–113.
- (2) Allen wrenches (supplied).
- (3) Tube puller (supplied).

49. Checking Key Circuits for Shorts

a. The purpose of the checks outlined in this paragraph is to make sure that when power is finally connected to the receiver-transmitter the equipment will not be damaged due to short circuits. Also, many types of trouble, such as shorted capacitors, faulty relay contacts, etc., may be discovered by means of these tests. Use Electronic Multimeter TS–505/U (M–1), or an equivalent meter, to check the resistance between each of the points on connectors J–309 through J–312 and chassis. The points of measurement and the required readings are summarized in the following table. For these measurements, power should be disconnected from the equipment.

Short-Circuit Checks

	J-309	J-310 or J-311	J-812
A	infinity	24	24
B	110,000*	0	24
C	infinity	15	15
D	0	nfinity	0
E	0	0	24
F	infinity	infinity	24
H	infinity	0	infinity
J	infinity	infinity	infinity
K	infinity	infinity	infinity
L	5	24	
M	infinity		
N	infinity		
P	infinity		
R	5,000		

*After capacitor charge indication.

b. If a required reading is not obtained, refer to the schematic diagram for the particular unit (fig. 53, 54, or 55) to determine which part or parts may be responsible for the trouble. Incorrect readings may be due to shorted or leaky bypass capacitors, defective relay contacts, resistors, or a wire or lug on one of the parts shorted to the chassis. Check each capacitor in the affected circuit section for leakage or short, and replace if necessary. Check the wires, lugs on components, and contacts of switches. Repair as necessary. Do not apply power until the trouble is cleared and all the readings indicated in the table are obtained.

Note. The resistance reading between terminal B of J-309 and chassis should show a capacitor charge and should reach about 110,000 ohms, since SQUELCH control potentiometer R-302, resistor R-177 and filter capacitors of the 85-volt circuit are arranged in series-parallel connections across these two points. A shorted or leaky filter capacitor anywhere on the 85-volt supply lead may bring this reading down to some considerably lower finite value or to zero. The finite resistance reading obtained then will depend on the extent of the leakage and the value of the associated filter resistor. For example, a completely shorted capacitor C-201B will cause a reading of 100 ohms or less to be obtained, since that is the value of the associated resistor, R-177, shunting the 85-volt circuit to ground.

50. Test Bench Set-up for Operational Check Using Power Supply PP-109/GR or PP-112/GR (fig. 43)

If the receiver-transmitter is to be tested apart from the components with which it is normally associated in an operating installation, it is necessary to connect to it an antenna load, a source of operating power, and audio sending and receiving devices.

a. Antenna Load. If a dummy antenna load is to be used, proceed as follows:

(1) Connect a 40-ohm, 100-watt, noninductive type resistor in series with an r-f output meter (par. 48*g*). Connect the series ar-

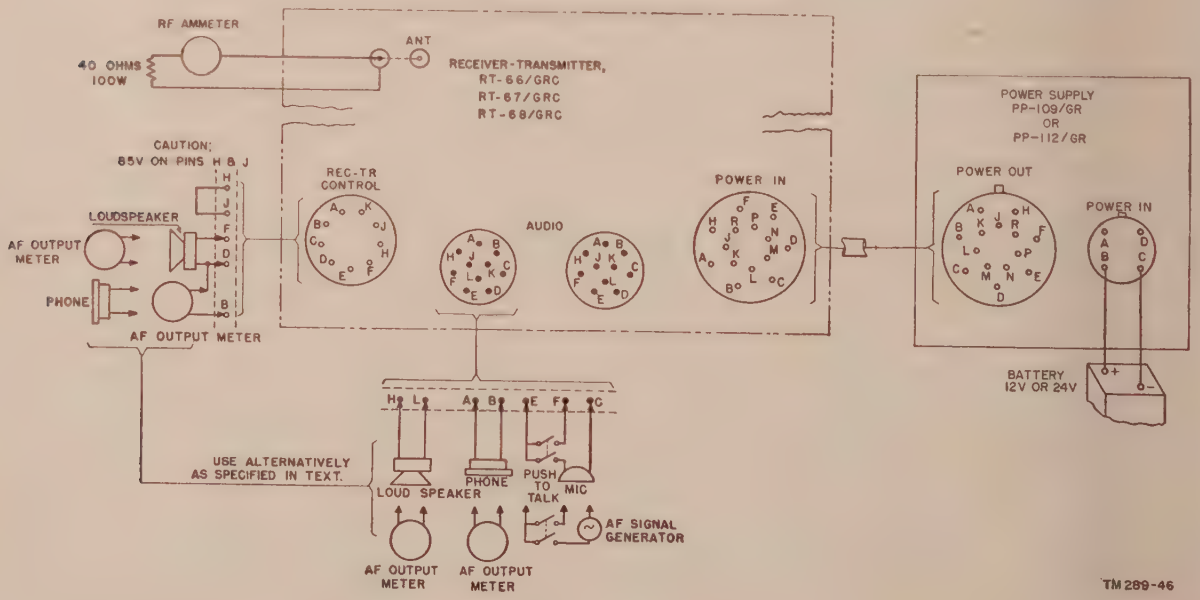


Figure 43. Test set-up, functional diagram.

Figure 44. Dummy antenna.

rangement of the two to one end of a short piece of coaxial cable. Fit the other end of the cable with a coaxial connector plug (male) to mate with the coaxial ANT connector J–307 on the front panel.

(2) If a 40-ohm, 100-watt, noninductive type resistor is not available, an alternate type of dummy load (fig. 44) can be constructed.

(3) Connect the dummy load prepared into the ANT connector of the receiver-transmitter.

b. Audio Devices. The term audio devices applies to microphone, headset, handset, and loudspeaker or to audio signal generator and a-f output meters. These devices are to be used as called for in the individual tests. However, the procedure for connecting the two types of audio devices is the same. The procedure is as follows:

(1) Connect the carbon element of the microphone in series with one set of contacts of the push-to-talk switch (or an audio signal generator (G–3) in series with one section of a DPST (double-pole, single-throw) switch) between terminals C and E (ground) of either AUDIO connector J–310 or J–311.

(2) Connect the other set of contacts of the microphone push-to-talk switch (or the other section of the DPST switch) between terminals F and E (ground) of connector J–310 or J–311.

(3) Connect a headphone or the earpiece of a handset (or an a-f output meter, M–3) between terminals A and B of connector J–310 or J–311.

(4) Connect a loudspeaker (or an a-f output meter, M–3) between terminals L and H (ground) of connector J–310 or J–311 and between terminals F and D (ground) of J–312.

(5) Connect a headphone (or an a-f output meter, M–3) between terminals B and D (ground) of connector J–312.

Note. If desired, a switching arrangement may be provided to connect M–3, phones, or the loudspeaker to the terminals called for in the test procedures. It is not necessary to duplicate meters, phones, or loudspeakers.

c. External Control Connection. Connect the jumper (supplied) across terminals H and J of connector J–312.

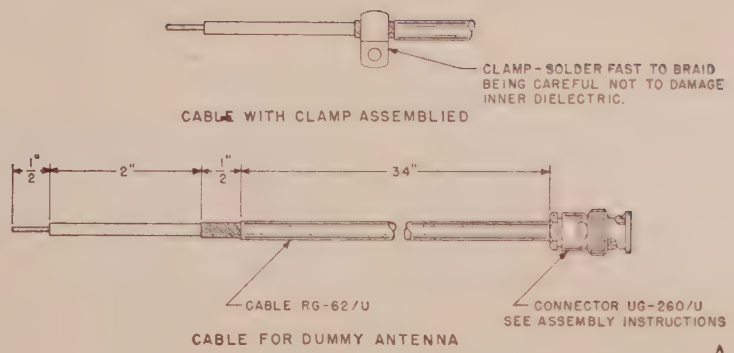
d. Power Supply. The power source may be either of the following combinations: Power Supply PP–109/GR and a 12-volt storage battery or Power Supply PP–112/GR and a 24-volt storage battery. Proceed as follows:

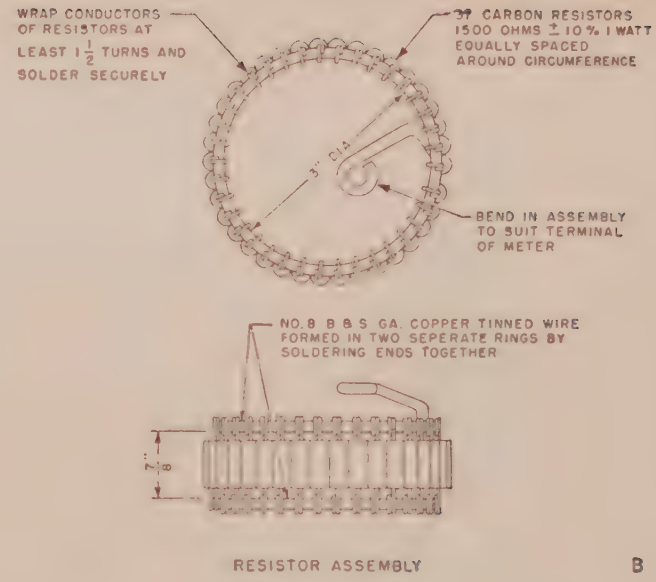
(1) Prepare a suitable 14-lead cable (par. 48*h*(6)). Fit each end of the cable with the 14-pin multiconnector. The cable is to be made of 3 #16 wires connected between pins D, L, and N and 11 #20 wires between the remaining pins. (Power Cable Assembly CX–1210/U can be used instead, if pins B and M on J–309 are shorted together.) The use of this cable will supply reduced plate voltage to the power audio stage V–116.

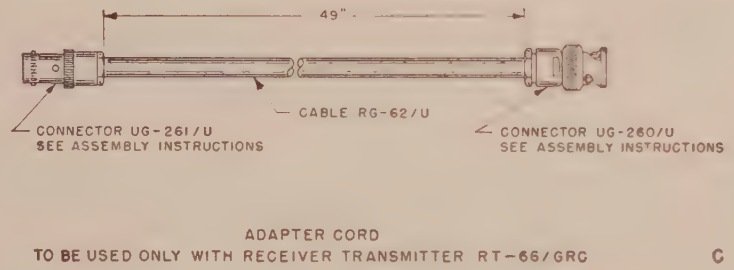
(2) At this point make sure that the OPERATE switch on Power Supply PP–109/GR or PP–112/GR is in the OFF position, and the TRANS POWER switch on that unit is in the LOW position.

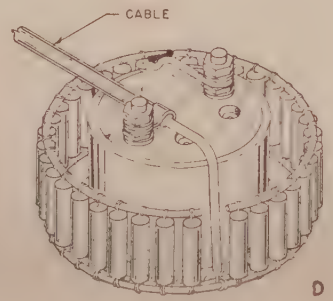
(3) Connect the cable between the POWER IN connectors of the two units.

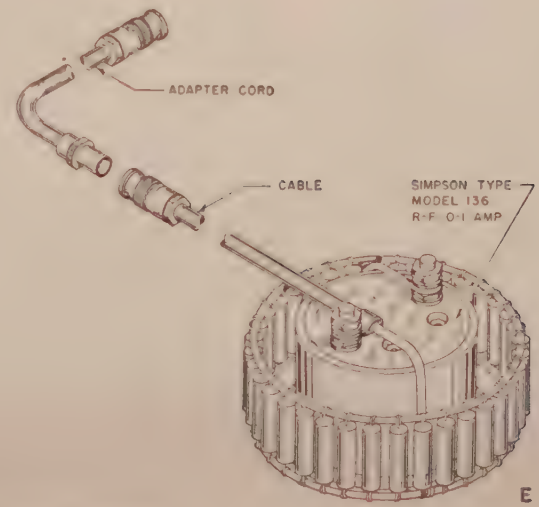
(4) Fit one end of a heavy-duty two-conductor




WRAP CONDUCTORS OF RESISTORS AT LEAST 1 1/2 TURNS AND SOLDER SECURELY
37 CARBON RESISTORS 1500 OHMS ± 10% 1 WATT EQUALLY SPACED AROUND CIRCUMFERENCE
3" DIA
BEND IN ASSEMBLY TO SUIT TERMINAL OF METER
NO.8 B&S GA. COPPER TINNED WIRE FORMED IN TWO SEPERATE RINGS BY SOLDERING ENDS TOGETHER
2 1/8"
RESISTOR ASSEMBLY
B



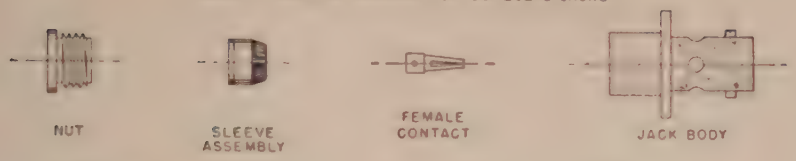


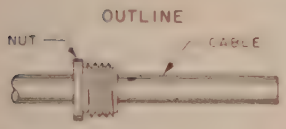


TM 289-60

Figure 45. Construction of dummy antenna.

RG-62/U CABLE IN UG-261/U OR UG-262/U JACKS

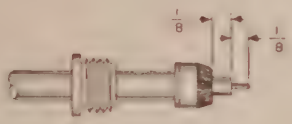




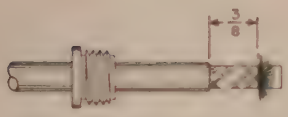
1 CUT OFF SHARP

6 WITH SLEEVE IN PLACE, COMB OUT BRAID, FOLD BACK SMOOTH AS SHOWN, AND TRIM TO $\frac{3}{32}$ INCH FROM END.

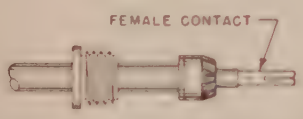
2 CUT OFF JACKET $\frac{1}{2}$ INCH FROM END, BEING CAREFUL NOT TO NICK BRAID.



7 CUT INNER DIELECTRIC $\frac{1}{8}$ INCH FROM BRAID, BEING CAREFUL NOT TO NICK INNER CONDUCTOR AND CUT OFF INNER CONDUCTOR $\frac{1}{8}$ INCH FROM END OF DIELECTRIC.

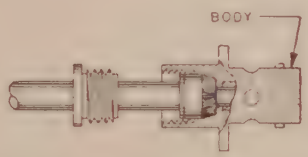


3 CUT OFF INNER INSULATION AND WIRE UNDER BRAID $\frac{3}{8}$ FROM END OF JACKET.

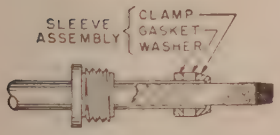


8 TIN INSIDE HOLE OF FEMALE CONTACT, TIN CENTER CONDUCTOR OF CABLE, SLIP FEMALE CONTACT IN PLACE AND SOLDER, REMOVE EXCESS SOLDER. BE SURE CABLE DIELECTRIC IS NOT HEATED EXCESSIVELY AND SWOLLEN SO AS TO PREVENT DIELECTRIC ENTERING BODY.

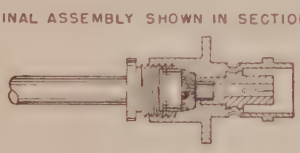
4 TAPER BRAID



9 PUSH INTO BODY AS FAR AS IT WILL GO, THEN SLIDE NUT INTO BODY AND SCREW INTO PLACE, WITH WRENCH, UNTIL MODERATELY TIGHT. HOLD CABLE AND SHELL RIGIDLY AND ROTATE NUT.



5 SLIDE SLEEVE OVER TAPERED BRAID TO FIT TIGHT AGAINST JACKET. BE SURE INNER SHOULDER OF SLEEVE FITS SQUARELY AGAINST END OF CABLE JACKET.



10 THE ASSEMBLY FOR PLUGS IS THE SAME EXCEPT FOR THE USE OF MALE CONTACTS AND A UG-260/U BODY.

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Figure 46. Assembly instructions for connectors, Plug UG-261/U and Jack, UG-261/U to cables.

battery cable with battery clips for connection to the storage battery. Fit the other end of the cable with a four-prong connector to mate with POWER IN connector J–1 on the power supply unit.

(5) Connect the battery cable between the battery and the power supply unit. In doing this, make sure that the correct polarity is observed.

51. Purpose and Use of Operational Check Chart

a. Purpose. The operational checks (par. 52) serve as a first step in sectionalizing trouble in the receiver-transmitter. The panel-mounted controls and facilities are used to operate the equipment under as close to normal conditions as possible at a test bench. In some cases, internal measurements at key test points are made. The trouble symptoms yielded by these checks, when properly interpreted on the basis of the repairman's knowledge of the circuit arrangement of the receiver-transmitter (ch. 2), will point to specific circuit sections as being defective, and to additional checks necessary to further limit the trouble to a particular stage.

b. Circuit Sections for Operational Checks. For the purpose of the operational checks, the circuits of the receiver-transmitter may be grouped functionally into the following sections:

(1) H-f portion of receiver, including—
- (*a*) Receiver r-f amplifier and receiver first mixer.
- (*b*) Crystal oscillator-harmonic generator.
- (*c*) First harmonic amplifier.

(2) L-f portion of receiver, including—
- (*a*) Receiver oscillator, receiver second mixer, first fixed i-f amplifier, first and second variable i-f amplifiers, and first and second limiters.
- (*b*) Discriminator.
- (*c*) Receiver audio amplifiers.

(3) Transmitter l-f section, including—
- (*a*) Microphone circuit.
- (*b*) Transmitter oscillator.
- (*c*) Reactance modulator.

(4) Transmitter h-f section, including—
- (*a*) Crystal oscillator-harmonic generator.
- (*b*) First and second harmonic amplifiers.
- (*c*) Transmitter mixer.
- (*d*) Transmitter r-f amplifier.
- (*e*) Transmitter driver.
- (*f*) Transmitter power amplifier.

(5) Push-to-talk control circuits.

(6) Ringer oscillator.

(7) Squelch circuit.

c. Additional Trouble Sectionalization Data. The operational check chart (par. 52) is supplemented by a group of check charts which serve to further limit the trouble to a particular stage within the circuit section determined as being defective by the operational checks. These charts include—

(1) Receiver trouble sectionalization chart (par. 53).

(2) Transmitter trouble sectionalization chart (par. 54).

(3) Receiver-transmitter tracking check chart (par. 55c).

(4) Filament circuit trouble localization chart (par. 56).

d. Use of Operational Check Chart. The tests given in the operational check chart follow a certain specific sequence. In each test it is assumed that the preceding tests have been made and that the troubles discovered have been eliminated. Accordingly, start with item 1 and proceed in the indicated order. The chart includes several columns, as follows:

(1) *Item of check.* This column assigns the numerical sequence to the particular check to facilitate future reference to it and describes briefly the purpose of each check.

(2) *Test condition or operation.* This column lists the switches and controls to be operated and the conditions to be met. The microphone, headset, handset, loudspeaker, power supply, and the *standard receiver-transmitter* (called for in some cases) are not part of the set being tested, but are needed in making the tests. To facilitate identification, meter and signal generator references corresponding to those given in paragraph 48 are included. It should be noted, however, that the nature of the normal indication (next column) should serve as a guide in the selection of meters and signal generators.

(3) *Normal indication.* Both aural and visual indications are outlined to show what to expect after the test conditions have been met. If these indications are not met as

specified, a trouble condition exists. For best results the repairman should be acquainted sufficiently well with the circuit theory and the actual operational behavior of the receiver-transmitter to be able to give correct interpretation to the *normal indications*. For example, in the case of item 3, which is a qualitative check of receiver operation based on the presence of noise in the r-f and i-f circuits, absence of noise shows that the receiver is defective at some point. Audibility of the noise does not prove conclusively, however, that the entire receiver functions properly. The r-f stage may be defective and yet noise may be heard in the earpiece. Since the volume of noise is a function of the total gain of the stages, a defect in the r-f and mixer stages of the receiver will show up as a reduction in the volume of noise heard. The same is true of the sidetone check. Proper interpretation of the volume of sidetone will give a more precise meaning to the *normal indication* for item 13.

(4) *Possible causes of trouble.* This column indicates the circuit sections to be suspected as being defective if the normal indication is not obtained. In cases where several types of trouble symptoms are possible, the circuit sections involved in each type of trouble symptom are listed.

(5) *Further checks.* This column lists further sectionalization or localization checks to be made if the normal indication is not obtained. Where further operational checks in the operational check chart are called for, perform each operational check, note the resultant indication and, if abnormal, follow through as indicated in the *further checks* column for that operational check. Where reference is made to the supplementary trouble-shooting charts (as listed in *c* above), it usually will not be necessary to perform all the checks listed in the supplementary chart, but only for the circuit group or groups called for by the particular *possible causes of trouble* and *further checks* of the operational check chart.

52. Operational Check Chart

Caution: Turn off power when making resistance or continuity measurements.

Item of check	Test condition or operation	Normal indication	Possible causes of trouble	Further checks
Preliminary	(a) Set up the receiver-transmitter as shown in figure 43 and as described in paragraph 50. (b) Turn DIAL LIGHT (ON-OFF)-RING switch to OFF position. (c) Turn power supply OPERATE switch to TRANS & RECEIVER. (d) Turn power supply TRANS POWER switch to LOW.			
(1) Receiver tube filaments circuits.	Turn METER switch in succession to each of positions 7 through 11.	Panel meter reads near center of scale for each switch position.	Defective receiver tube filament or filament circuit component.	Make checks indicated in filament circuit trouble localization chart (par. 56) for particular METER switch position.
(2) Filament circuit of receiver tube V–1.	Visually note whether tube V–1 is lit	Tube V–1 is lit	Defective wiring or filament of V–1.	Check V–1 and filament circuit of V–1 (fig. 31).
(3) Over-all receiver operation (rough check).	VOLUME control in maximum clockwise position, SQUELCH control in extreme counterclockwise (OFF) position.	Rushing noise is heard in earphones and in loudspeaker.	Defective receiver	(a) Check coaxial cable, connector P–1, and J–101 (fig. 4) to see that they are connected properly. (b) Make listening check in item 4, below.
(4) Over-all receiver operation (listening check).	Same as in item 3. Apply a carrier signal with 1-kc modulation at ±15-kc deviation (G–2) and at a level of 2 μv (microvolt) to ANT connector. Tune in signal with MCS and TENTH MCS dials. (Alternatively, a signal from a transmitter, possibly the ringing signal, may be tuned in and used for this check.)	Tone should be heard in all three audio output connections.	If no signal is heard at any of the three audio output connections, a defective circuit exists at some point in the receiver.	Make sidetone check in item 13 to sectionalize the trouble to receiver circuits preceding or following the receiver second mixer stage. Follow up with appropriate checks indicated in the receiver trouble sectionalization chart (par. 53), items 1 through 8 and 11 or 8 through 10.
	(a) Connect a headset between A of J–310 or J–311 and chassis.		(a) If a signal is heard at B of J–312 but not at A of J–310 or J–311, the first a-f amplifier circuit is defective.	(a) Check the circuit associated with V–115 and the tube (par. 53, item 1).
	(b) Connect a headset between B of J–312 and chassis.		(b) If a signal is heard at A of J–310 or J–311 but	(b) Check the circuits associated with V–102 and tube V–102 (par. 53,

			retransmit audio amplifier stage, V–102, is defective.	
	(c) Connect a loudspeaker between L of J–310 or J–311 and chassis.	----------	(c) If a signal is heard at A but not at L of J–310 or J–311, the audio power amplifier stage is defective.	(c) Check V–116 and the circuits associated with it (par. 53, item 1).
(5) VOLUME control-----	Same as in item 4. Slowly rotate the VOLUME control in the counterclockwise direction.	Receiver output level is gradually reduced as control is rotated.	Defective potentiometer R–303 or associated circuit components.	Check R–303 and associated wiring and circuit components.
(6) Receiver squelch operation.	Same as in step 4. Reduce test signal input level to zero. Gradually advance SQUELCH control in the clockwise direction. Listen in headphones or loudspeaker. Measure test signal input level.	The rushing noise should disappear more or less abruptly as the control is advanced in the clockwise direction.	(a) Defective squelch circuit.	(a) Check squelch oscillator tube V–103 and squelch circuit (par. 53, item 11).
			(b) Poor receiver sensitivity.	(b) Check receiver stage gain (par. 57).
(7) Over-all receiver operation (quantitative checks).				
(a) Audio output------	(a) Rotate SQUELCH control to extreme clockwise position. Raise test signal level until tone is heard in headphones and loudspeaker. Connect a-f output meters (M–3) in place of headphones and loudspeaker.	(a) Meter readings should be as follows: A of J–310 is at least .05 watt. L of J–310 is 1.0 watt. B of J–312 is .03 watt (nominal).	(a) Incorrect stage gains, particularly a-f amplifiers, and misalined discriminator.	(a) Make checks in steps (7) (b), (c), and (d) below. Follow up with checks indicated in receiver trouble sectionalization chart (par. 53, items 1 and 2).
(b) Receiver frequency----	(b) Remove modulation from test signal. Connect M–1 between terminals 7 and 1 of test socket X–200.	(b) Discriminator meter reads zero when test signal frequency is tuned in correctly.	(b) Receiver oscillator (V–101) or crystal oscillator-harmonic generator (V–3) off-frequency. Misalined discriminator circuit.	(b) Check frequency of oscillators as described in item 8. Follow up with appropriate checks in paragraph 53, item 8 or paragraph 54, items 1, 2, 3, and 4. Check discriminator circuit alinement as described in receiver trouble sectionalization chart (par. 53, item 4).
(c) Over-all receiver sensitivity.	(c) Apply unmodulated r-f test signal (G–1) as before. Connect M–1 between terminals 5 and 1 of X–200. Adjust signal input level to 1.0 μv.	(c) Meter reads at least 1 volt.	(c) Defective receiver stage.	(c) Check receiver alinement, step (d) below, and stage gains (par. 57).

Item of check	Test condition or operation	Normal indication	Possible causes of trouble	Further checks
(d) Receiver alinement	(d) Remove test signal. Connnect meter (M–1) between terminals 7 and 1 of X–200.	(d) Meter should read 0±1.6 volts.		(d) Recheck item (7)(b).
	(e) Connect meter (M–1) to terminals 5 and 1 of X–200. Set MCS dial to any convenient setting. Set TENTH MCS dial to 0. Apply calibrated unmodulated test signal at the frequency of the MCS dial setting and at a level of approximately 1 μv to the ANT connector. Vary test signal frequency until meter shows a peak reading. Note the test signal frequency for which the peak reading occurs.	(e) The meter peaks for test signal frequency within 10 kc of nominal dial frequency.	(e) Misalined oscillator. Misalined i-f or r-f amplifier stages.	(e) Check in accordance with receiver trouble sectionalization chart (par. 53, items 7, 8, and 9) and realine in accordance with paragraph 71.
(8) Receiver oscillator tracking.	(a) Couple a frequency meter (M–5) to the receiver oscillator by placing a few turns of wire over tube V–101 and connecting the ends of the wire to the frequency meter. Turn MCS dial to any convenient detent position.	(a) At zero setting of TENTH MCS dial, the frequency meter should read 3.05 mc. A tolerance of ±5 kc is allowed.	(a) Incorrect alinement of receiver oscillator.	(a) Realine receiver oscillator V–101 (par. 71). Check tuning mechanism as in item 9.
	(b) Turn TENTH MCS dial in succession to each of its detent positions (starting with 0), and measure the frequency for each.	(b) As the dial is advanced, the frequency shown by the meter should increase in 100-kc steps.	(b) Defective TENTH MCS dial mechanism.	(b) Check and readjust detent screw settings (par. 76). Check mechanical alinement (par. 65).
(9) Tuning mechanism and mechanical couplings.	Repeat item 8, returning to each detent position several times.	The same frequency (within ±1 kc) should be measured every time the dial is returned to the particular position.	Loose or broken couplings. Loose or defective detent stop screws.	Inspect and adjust as described in paragraph 71e and adjust or repair as described in paragraphs 64 and 65.
(10) Transmitter tube filaments and filament circuits.	DIAL LIGHT (ON-OFF)-RING switch in OFF position. OPERATE switch on power supply in TRANS & REC ON position. TRANS POWER switch on power supply in LOW position.	Panel meter reads near center of scale for each switch position.	(a) Defective transmitter tube filament or filament circuit component. (b) Defective control circuit, particularly relay O–101.	(a) Refer to filament circuit trouble localization chart (par. 56). (b) Make point-to-point resistance and voltage measurements (pars. 58 and 59).

	Turn METER switch successively to each of positions 2 through 6, operating microphone push-to-talk button each time.			
(11) Filament of tube V–11.	Operate microphone push-to-talk button and observe whether tube V–11 is lit.	Tube should be lit	Defective V–11 filament or filament circuit.	Check tube and wiring.
(12) Transmitter power output (low power).	Same as step 10, except: METER switch in RF position. Antenna load connected. TENTH MCS dial in 0 position. MCS dial set to lowest mc position. Push-to-talk switch operated. Observe panel meter reading.	Meter should read approximately one-third of full scale.	(a) Defective l-f generator circuits (including transmit oscillator and modulator).	(a) Make sidetone check, item 13, below.
			(b) Defective h-f generator circuits (including crystal oscillator-harmonic generator and first and second harmonic amplifiers).	(b) Make measurements indicated in paragraph 54, items 1 through 4.
			(c) Defective transmitter h-f circuits (including mixer, r-f amplifier, driver, and power amplifier).	(c) Make measurements indicated in paragraph 54, items 5 through 13.
			(d) Defective relay circuits.	(d) Make voltage measurements at the following points (to chassis): Term. 4 of J–106; (85 volts). Term. 3 of J–4; (85 volts). Term. 3 of X–11; (250 volts). Term. 1 of X–9; (150 volts). Make voltage measurements at terminals of relays O–1 and O–101 (par. 59).
(13) Sidetone check	Same as in item 12. Talk into microphone. Listen in headphones and loudspeaker.	Sidetone is heard	(a) Defective modulator or transmit oscillator.	(a) Make measurements indicated in paragraph 54, items 5, 6, and 7.
			(b) Defective relay O–101 circuits.	(b) Measure voltage between terminal 4 of O–101 and chassis. A reading of 6.3 volts should be obtained. Measure voltage between terminal 8 of O–101 and chassis. A reading of 85 volts should be obtained.

Item of check	Test condition or operation	Normal indication	Possible causes of trouble	Further checks
				If above readings are not obtained, relay O–101 or its circuits are defective. Turn off power and make point-to-point resistance measurements indicated in paragraph 58.
			(c) Defective microphone circuit.	(c) Make ringing check, item 14. By elimination, the microphone circuit is probably faulty if ringing sidetone is heard. Make point-to-point resistance measurements (par. 58).
			(d) Defective receiver circuits between receiver second mixer and audio output circuits.	(d) Make the checks indicated in items 7, 1, 2, 4, and 5, paragraph 53.
(14) Ringing check	Same as in item 12. Operate S–302 to RING. Do not operate push-to-talk switch.			
	(a) Listen in headphones or loudspeaker.	(a) 1,600-cycle sidetone is heard.	(a) Defective ringer oscillator, V–104.	(a) Make measurement indicated in paragraph 54, item 12. Follow up with point-to-point resistance and voltage measurements (pars. 58 and 59).
	(b) Observe panel meter with METER switch in position 1.	(b) Meter reads at least one-third of full scale.	(b) Defective relay circuits.	(b) See item 13 above.
	(c) Observe dial light	(c) Dial light goes on	(c) Defective switch S–302.	(c) With switch S–302, in RING position, check for continuity between terminals 4 and 6 of J–106, and between terminal F of J–310 and chassis. If zero readings are not obtained for both measurements, the switch contacts are open. Check switch and associated wiring.
(15) Dial light circuit	Same as above, but turn S–302 to DIAL LIGHT ON.	1,600-cycle tone disappears, light stays on.	Defective dial light or associated circuit components and wiring.	Refer to schematic diagram (fig. 19) and check dial lamp circuit for continuity.

	Turn S–302 to DIAL LIGHT OFF	Light goes out	Defective S–302 contacts	
(16) Over-all transmitter frequency, tracking and dial calibration.	Same as in item 12. Couple frequency meter to antenna load (M 5). Rotate MCS dial in succession to each of its mc detent positions. Operate push-to-talk switch for each dial position and read frequency meter.	For each setting of the dial the frequency meter shows a frequency which is within 7.5 kc of the nominal frequency indicated by the dial.	a. MCS control requires recalibration.	a. Check mechanical alinement (par. 65). Check calibration and alinement with reference to paragraph 55.
			b. Crystal oscillator-harmonic generator and harmonic amplifier off frequency or defective.	b. Check in accordance with paragraph 54, items 1 through 4. Follow up with mechanical alinement (par. 65) and electrical alinement (par. 71).
			(c) Transmit oscillator off frequency or defective.	(c) Check in accordance with paragraph 54, items 5, 6, and 7. Follow up with alinement (pars. 65 and 72).
(17) Transmitter power output (HIGH power).	Same as in item 12, except as follows: DIAL LIGHT (ON-OFF)-RING switch on RING. TRANS POWER switch on power supply on HIGH. METER switch on RF.	Meter on front panel reads at least one-half of full scale.	Transmitter high-frequency circuits need alinement (particularly driver and power amplifier stages and antenna circuit).	Aline in accordance with paragraph 72, with high power applied.

53. Receiver Trouble Sectionalization Chart

Item of check	Test conditions	Test signal connections	Level	Frequency	Meter connections	Meter readings	Further checks
(1) Variable gain audio circuits V–115 and V–116.	SQUELCH control in OFF position. VOLUME control in maximum clockwise position. DIAL LIGHT (ON-OFF)-RING switch in OFF position. OPERATE switch on power supply in RECEIVER ON position. Switch between H and J of J–312 closed.	Audio oscillator (G–3) between pin 3 of V–113 (discriminator output) and ground.	10 volts	1,000 cps.	(a) Between A and H of J–310 (M–3).	At least 50 mw	a. Make detailed check of first audio amplifier stage V–115. See point-to-point resistance chart (par. 58) and point-to-point voltage chart (par. 59). Check V–115. Check R–303 and associated components.
					(b) Between L and J of J–310.	At least 1 watt	(b) Make detailed check of power audio stage V–116. See point-to-point resistance and voltage charts (pars. 58 and 59).
(2) Retransmit audio stage V–102.	Same as above	Audio oscillator (G–3) between pin 3 of V–113 and chassis.	3.0 volts rms	1,000 cps	Between B and D of J–312 (M–3).	30 mw. nominal.	Make detailed check of retransmit audio stage V–102. See point-to-point resistance and voltage charts (pars. 58 and 59). Adjust R–103 to obtain required output.
(3) Discriminator tuning.	Same as above. SQUELCH control OFF.	Same as above. Use i-f signal generator (G–2).	0.5 volt rms.	1.4 mc			If incorrect reading is obtained, make the following additional checks:
					(a) Between 7 and 1 of X–200 (M–1).	(a) 0±.05 volt	(a) Check V–112 point-to-point resistances (par. 58) and voltages (par. 59). Aline discriminator for circuit (T–113) (par. 71).
					(b) Between 3 of X–113 and chassis (M–1).	(b) 15 volts maximum.	(b) Check tubes V–113 and V–114.

(4) Discriminator balance.	Same as above.	Signal generator (G–2) between pin 6 of V–112 and chassis.	0.5 volt rms.	1.43 mc.	(a) 6 and 2 of X–200 (M–1).	(a) +10 volts minimum.	The two readings should be of opposite polarity and numerically equal to within 5 volts.
				1.37 mc.	(b) 6 and 2 of X–200 (M–1).	(b) −10 volts, minimum.	If these requirements are not met, check discriminator components involved in maintaining balance (par. 58).
(5) Spurious i-f oscillations.	Same as above.	None.	None.	None.	7 and 1 of X–200 (M–1).	0.09 volt.	If a much greater current is obtained, the fixed i-f amplifier response is nonsymmetrical. Check the fixed i-f circuits for symmetry (par. 79) and realine (pars. 65 and 71).
(6) Receiver second mixer and fixed i-f amplifier.	Same as above.	Signal generator (G–2) between pin 6 of V–109 and chassis.	3,000 μv.	1.1 mc.	5 and 1 of X–200 (M–1).	6 volts.	If the meter reading is not obtained, check individual stage gains (par. 57) for V–109 through V–112. Aline fixed i-f amplifiers, V–109 through V–112 (pars. 65 and 71).
(7) Receiver oscillator tracking.	(a) TENTH MCS (kilocycle) dial in detent position 0.	Signal generator (G–2) between: (a) Pin 6 of V–109 and chassis.	(a) 4,000 μv.	(a) 4.45 mc.	(a) 7 and 1 of X–200 (M–1).	(a) +.16 volt.	
	(b) TENTH MCS dial in detent position 9.	(b) Pin 6 of V–109 and chassis.	(b) 3,800 μv.	(b) 5.35 mc.	(b) 5 and 1 of X–200 (M–1).	(b) 0.6 volt.	
	(c) Change setting of TENTH MCS dial successively through positions 1 through 9.	(c) Pin 6 of V–109 and chassis.	(c) 3,800 μv.	(c) For each detent position of dial increases test signal frequency by 100 kc.	(c) 7 and 1 of X–200 (M–1). 5 and 1 of X–200 (M–1).	(c) 0.05 volt for each reading. 0.6 volt for each reading.	(c) If the tracking error exceeds the limits specified, realine the oscillator and the fixed i-f amplifier (pars. 65 and 71). Check the kc-dial calibration (par. 71).

Item of check	Test conditions	Test signal connections	Level	Frequency	Meter connections	Meter readings	Further checks
(8) Receiver first mixer and variable i-f amplifier-gain measurement.	(a) TENTH MCS dial in position 0.	Signal generator (G–2) between pin (a) 6 of V–2 and chassis.	(a) 57 μv	(a) 4.45 mc	(a) 7 and 1 of X–200 (M–1). 5 and 1 of X–200 (M–1).	(a) ±.16 volt 1.5 volts	(a) Check gain of individual stages V–2 and V–107 through V–109. Check alinement of variable i-f amplifier (pars. 65 and 71).
	(b) TENTH MCS dial in position 9.	(b) Same as above	(b) 29 μv	(b) 5.35 mc	(b) Same as above.	(b) Same as above.	(b) Same as above.
(9) Receiver r-f amplifier.	(a) TENTH MCS dial on 0.	Use signal generator G–1 for the connections below (a) ANT connector.	(a) 0		(a) 7 and 1 of X–200 (M–1). 5 and 1 of X–200 (M–1).	(a) 0 ± .16 volt 2 to 0.7 volt.	
	(b) MCS dial turned to frequency indicated in the frequency column.	(b) ANT connector on Receiver-Transmitter RT–66/-GRC.	(b) 0.4 μv .3 μv	(b) 20 mc 27 mc	(b) 5 and 1 of X–200 (M–1).	(b) 1.5 volts	(b) Make stage gain checks (par. 59). Aline r-f circuits (pars. 65 and 70).
		(c) ANT connector on Receiver-Transmitter RT–67/-GRC.	(c) 0.4 μv .3 μv	(c) 27 mc. 38 mc.	(c) 5 and 1 of X–200 (M–1).	(c) 1.5 volts	(c) Same as (b).
		(d) ANT connector on Receiver-Transmitter RT–68/-GRC.	(d) .7 μv .5 μv	(d) 38 mc. 54 mc.	(d) 5 and 1 of X–200 (M–1).	(d) 1.5	(d) Same as (b).
(10) Squelch circuit	Same as in item 1. SQUELCH control in extreme clockwise position.	None			Pin 2 of V–103 and chassis or term. 6 of terminal board A (M–1).	−40 volts to −70 volts.	Make point-to-point resistance (par. 58) and voltage (par. 59) measurements for V–103.

54. Transmitter Trouble Sectionalization Chart

Item of check	Test conditions	Meter connections	Normal reading	Additional checks and remarks
Preparatory	Power supply OPERATE switch in RECEIVE & TRANSMIT position. Power supply TRANS POWER switch in LOW position. S 302 in OFF position. METER switch in RF position. Antenna load connected.			Until trouble in the transmitter has been definitely cleared, the TRANS POWER switch should be kept in the LOW position to prevent additional damage to the equipment.
(1) Crystal oscillator	TENTH MCS dial to 0 detent position MCS dial successively to each detent position, starting with lowest mc setting.	Connect M 1 between stand-off insulator 3J and chassis.	9 to 20 volts for each MCS dial setting.	Check V 3. Make point-to-point resistance and voltage measurements (pars. 58 and 59). Check crystal associated with dial position for which incorrect reading is obtained. Check mechanical alinement of crystal switch S–1 (pars. 63 and 65).
(2) Harmonic generator	a) MCS dial in highest mc position	a) Connect M 1 between test point E–4H and chassis.	a) 0.4 volt minimum	a) Try adjusting tuning slug of L 6 in tuning unit T–3 for a peak reading on meter. Try adjusting trimmer capacitor C–16 for peak reading on the meter. If steps (a) and (b) fail to produce the required readings, check mechanical alinement (par. 65). Check V–3. Make sure that marker lines on gears mounted on C–17 line up to form a straight line. Check circuit components by point-to-point resistance and voltage measurements (pars. 58 and 59). Realine circuit (par. 72).
	(b) MCS dial in lowest mc position	(b) Same as above	(b) Same as above	(b) Same as above.
(3) First harmonic amplifier, V–4.	(a) MCS dial in highest mc position	(a) Connect M 1 between E–2E and chassis.	(a) 1.0 to 4 volts	(a) Try adjusting tuning slug of L 8 in T–4 for a peak reading on the meter. Try adjusting trimmer capacitor C–26 for a peak reading on the meter. If the above fails to produce the required reading:

Item of check	Test conditions	Meter connections	Normal reading	Additional checks and remarks
				Check tube V–4. Make point-to-point resistance and voltage measurements (pars. 58 and 59). Realine circuit (par. 72).
	(b) MCS dial in lowest mc position	(b) Same as above	(b) Same as above	(b) Same as above.
(4) Second harmonic amplifier, V–5.	Operate push-to-talk switch.			
	(a) MCS dial in highest mc position	(a) Connect M–1 between E–6A and E–6B.	(a) 2.2 to 3 volts	(a) Adjust tuning slug of L–9 in T–5 for a peak reading on the meter. Adjust trimmer capacitor C–33 for a peak reading on the meter. If the above fails to produce required reading: Check tube V–5. Check circuit components by point-to-point resistance and voltage measurements (pars. 58 and 59). Realine circuit (par. 72).
	(b) MCS dial in lowest mc position	(b) Same as above	(b) Same as above	(b) Same as above.
(5) Transmitter oscillator, V–104A.	VOLUME control in maximum clockwise position. SQUELCH control OFF. TENTH MCS in 0 position. MCS dial in lowest mc detent position. Operate push-to-talk button.	(a) Between 7 and 1 of X–200 (M–1).	(a) 0±.05 volt	(a) Defective or misalined transmitter oscillator circuit. Realine in accordance with paragraph 72. If alinement fails, check V–4. Make point-to-point resistance and voltage measurements (pars. 58 and 59). Defective discriminator circuit. Check in accordance with paragraph 53, items 3 and 4.
		(b) Between 5 and 1 of X–200 (M–1).	(b) 1.45 volts to 1.75 volts	(b) A no-reading indication points to a dead or badly misalined transmitter oscillator. *Note.* The output of the transmitter oscillator is fed back through the receiver circuits as sidetone. Accordingly, if the oscillator is on frequency and tracks with receiver oscillator V–101, the discriminator output will be zero, assuming that the discriminator functions properly.

(6) Transmitter oscillator tracking.	Same as above Set TENTH MCS dial successively to detent positions 0 through 9.	Between 7 and 1 of X–200 (M–1).	0±.16 volt	*Note.* Tracking error is determined by noting the extent to which the discriminator output differs from zero volt for each setting of the TENTH MCS dial. If the oscillator is off frequency for one or more detent positions but not for all positions, readjust the dial detent screws (par. 69). If the oscillator is off frequency for all dial positions by nearly the same amount, check mechanical alinement (par. 65) and electrical alinement (par. 72). If frequency cannot be changed by varying dial knob, there is slippage in gear couplings or a broken gear drive. Inspect and check mechanical alinement (par. 65). If the tracking error for any one or more dial positions exceeds 5 kc, check the adjustment of the detent screws (par. 71). If the tracking error exceeds 5 kc for all dial positions, check alinement (par. 72). Check modulator circuit as described in item 7 below.
(7) Modulator operation.	(a) Same as in item 5. Set S–302 to RING position.	(a) Between 7 and 1 of X–200 (M–1).	(a) 0.05 volt	(a) Note this check assumes that the transmitter oscillator and the receiver i-f and discriminator circuits are functioning.
	(b) Listen for sidetone in headphones and loudspeaker.		(b) Sidetone is heard	(b) If tone is not heard, or if incorrect meter reading is obtained, make point-to-point resistance and voltage measurements on modulator circuit. Check tubes V–105 and V–106.
(8) Transmitter mixer and r-f stages V–6, V–7, and V–8.	Operate push-to-talk switch. (a) MCS dial in highest mc position.	(a) Connect M–1 between E–7B and E–8G.	(a) 6 volts minimum	(a) Adjust tuning slug of L–12 in T–6 for a peak reading on the meter. Adjust trimmer C–1E for peak reading on meter. If above adjustments fail to provide the required readings: Check tubes V–6, V–7, and V–8.

Item of check	Test conditions	Meter connections	Normal reading	Additional checks and remarks
				Check circuit components by point-to-point resistance and voltage measurement. Realine circuits (par. 72). Also check to see if the cable from the i-f chassis is plugged in.
	(b) MCS dial in lowest mc position	(b) Same as above	(b) Same as above	(b) Same as above.
(9) Transmitter drivers, V–9 and V–10.	Operate push-to-talk switch.			
	(a) MCS dial in highest mc detent position.	(a) Connect M 1 between test points E–9F and E–9G.	(a) 3.5 volts minimum. (In RT–66/GRC, 2.5 volts minimum).	(a) Check tubes V–9 and V–10. Try adjusting L–18 and C–1K for peak readings on the meter. Realine the stage in accordance with paragraph 72. If alinement fails to provide correct reading, make point-to-point resistance and voltage measurements (pars. 58 and 59). *Do not touch neutralization adjustments.* These are sealed with glyptal at the factory. To determine whether neutralization is required, proceed as follows: After the required reading is obtained, disconnect P–2 and J–102 (coaxial cable from V–6 on r-f chassis to transmitter oscillator output on i-f chassis). Observe the meter. The voltage should drop to zero. If this requirement is not met, a neutralization adjustment is necessary. ***Caution:*** Neutralization adjustment is tricky. It should be performed by experienced personnel only.
	(b) MCS dial in lowest mc detent position.	(b) Same as above	(b) Same as above	(b) Same as above.
(10) Transmitter power amplifier V–11.	Same as (a) above	(a) Between E–9H and E–9J (M–1).	(a) 4-volt maximum	(a) Check alinement (par. 72) of plate circuit (L–22 and C–1L). Tune for a dip across E–9H and E–9J.

		(b) Panel meter with METER switch in RF position.	(b) Less than one-half scale.	Adjust TRANS ANT COUPLING for minimum coupling (extreme counterclockwise) for alinement of power amplifier stage.
		(c) Ammeter in dummy load.	(c) 0.5 ampere.	Check and adjust coupling control as described in paragraph 72.
				Check V 11 and associated circuit components (pars. 58 and 59).
				Caution: High voltages are present at the final stages of the transmitter. Be very careful not to touch any parts with fingers. Use insulated test probes. Wear rubber gloves.
				Check adjustment of TR ANT TUNE capacitor C–74, and of cam-adjusting screws. See item 11 below.
(11) Transmitter circuit tracking.	Operate push-to-talk switch Turn MCS dial in succession to each of its detent positions. TENTH MCS dial in position 0.	Between E 9H and L 9J (M 1). Panel meter with switch in RF position. Dummy load meter.		Decouple the TRANS ANT COUPLING (turn to extreme counterclockwise position). For each dial detent position, adjust corresponding REC ANT TUNE screw on cam to obtain a peak reading on the dummy load meter (par. 72). If peaking is not possible, or if after peaking, with the TRANS ANT COUPLING tuned for maximum output on meter in dummy load, the required meter readings are not obtained, refer to the transmitter tracking chart (par. 55) and make the measurements indicated there for the particular dial settings.
(12) Ringer oscillator.	Switch S 302 in RING position	Connect M 1 across winding 4–5 of T–106.	1.8 volts ac.	Make resistance and voltage measurements (pars. 58 and 59). Check V–104.

55. Receiver-Transmitter Tracking Check Chart

The readings obtained at the several test points of the transmitter circuits for the various detent settings of the MCS dial are shown in *c* below. It is assumed that the transmitter oscillator (4.45 to 5.45 mc) is working properly and that the tuning of the oscillator and calibration is correct. Check tracking of the TENTH MCS dial and associated capacitor as described in paragraph 71*e*. The values shown in the table are minimum values. Some deviation from these values is to be expected in a normally operating transmitter.

a. MEASUREMENT. For any setting of the MCS dial, with the TENTH MCS control in position 0, connect the vacuum-tube voltmeter (M–1) to each of the indicated test points in succession. Obtain the readings and record them for reference and comparison. These readings will serve as a calibration chart for the particular set. Note, however, that variations in the same set from time to time are to be expected due to some backlash and mechanical leakages. The push-to-talk button on the microphone must be operated and the full transmitter power applied. An alternative method of energizing the transmitter circuits is to connect ground to terminal K on the front panel REC-TR CONTROL connector. Compare the readings obtained with the data given in the chart.

b. ANALYSIS OF MEASUREMENT DATA. Proper interpretation of the measurement data will make it possible to locate the specific cause of the trouble.

(1) If, for a given MCS dial detent position, the reading for any of the test points, 3J, E–2L, E–4H, E–6A, or E–6B, is not correct, the tracking between sections of tuning capacitor C–17 is incorrect. Realine the crystal oscillator-harmonic generator circuits as described in paragraph 71*g*.

(2) If the readings for any of the other E test points are incorrect, the tracking of r-f tuning capacitor C–1 is incorrect. Realine in accordance with paragraph 71.

(3) If the readings for test points 3J, E–2L, E–4H, E–6A, and E–6B are correct, but those for the remaining E test points are incorrect, the coupling arrangement to capacitor C–1 is defective. (The transmitter oscillator is assumed to function properly.)

(4) If approximately the same output is not obtained whenever the MCS control is returned to a particular position, check the tightness of the detent screws and check for backlash in driver gears and the gear drive.

(5) If no tuning is possible by varying the control, there is slippage in the variable capacitor mechanical couplings (par. 65).

c. TRACKING CHECKS.

Circuit group	Item of check	Points of measurement (M–1)	Minimum acceptable meter readings at any mc detent position	Remedy if reading is incorrect
Crystal oscillator	Crystal activity	3J (V–3 pin 3)	9 volts	Change crystal.
Harmonic generator	Grid drive of V–4	E–4H and chassis	0.4 volt	Readjust L–6, C–16, or dial stop.
	Output of V–4	E–2L and chassis	1.0 volt	Readjust L–8, C–26, or dial stop.
	Output of V–5 and output of V–6.	E–6A (+) and E–6B (—)	2.1 volts	Readjust L–9, C–33, or dial stop.
				Readjust L–12 and C–1E
Transmitter r-f circuits.	Grid drive V–9 and V–10.	E–7B (+) and E–8G (—)	6.0 volts	Readjust L–16 and C–1G.
	Grid drive	E–9G (+) and E–9F (—)	3.5 volts, (2.5 volts in RT–66/GRC).	Readjust L–18 and C–1J and neutralization T–8 and C–65.
	Power output V–11	E–9H (+) and E–9J (—)	4.0 volts, (1 volt in RT–66/GRC).	Readjust L–22 and C–1M.
	Transmitter power output (series antenna current into a 40-ohm dummy antenna in the RT–66/GRC).	9M and chassis	0.5 ampere	TRANS ANT COUPLING (T–9), TRANT TUNE (C–74), or cam

56. Filament Circuit Trouble Localization Chart.

When testing the filament circuits in conjunction with the chart below, the METER switch must follow the sequence of the chart. In all cases the normal reading of the meter M–301 is center scale. If this reading is not obtained, the probable defective item is listed under the type of reading obtained.

METER switch position	Zero reading	Too low but not zero reading	Too high but not full-scale reading	Full-scale reading
2	L–13, C–49, C–50, C–46, C–51, L–14, C–60, C–301, R–47, C–64, combination of R–34 and V–7.	V–7	V–9	V–9, combination of V–9 and R–44.
3	L–15, C–52, C–61, R–48, C–63, combination of R–35 and V–8.	V–8	V–10	V–10, combination of V–10 and R–45.
4	L–11, C–42, V–6, C–41, R–28, C–43.	C–31		V–5, R–25.
5	C–135, R–124, L–116, R–125, C–139, combination of R–123 and V–106.	V–106		V–104.
6	V–105, R–121, C–136, C–134			R–122.
7	V–116, L–136, C–195, R–163, C–190, combination of R–161 or R–162 and V–114.	C–191, C–14, C–13	V–113, V–3	L–135, L–5, combination of R–14 and V–3, L–4.
8	L–7, V–4, R–19, C–23, C–22 combination or R–18 and V–4.		V–2	R–10, combination of R–9 and V–2
9	R–107, V–102, R–105, C–112, C–149.	C–116		V–107, L–107, V–103.
10	V–108, C–154, L–125, C–174, V–110, R–150, C–171.	R–148, R–149, C–179, C–178, C–185.	V–112	L–128, V–111, L–131, combination of R–159 and V–112.
11	R–176, C–144C, V–115, L–122, R–142, C–164, C–165.	C–163, C–107	V–109, V–101	L–105, L–106, L–102, combination of R–143 and V–109, combination of R–102 and V–101.

Note 1. The transmitter power amplifier tube, V–11, and the receiver first r-f amplifier tube, V–1, are not checked by the meter switch. These tubes must be checked by visual inspection. Observe whether (with power applied) the tube filaments are lit. The filament of V–121 is energized when the microphone push-to-talk button is operated.

Note 2. Because of the series-parallel arrangement of the tube filaments, a break in the filament of one tube in a series string of tubes will cause all the other tubes in the string to go out and will produce indications of a faulty stage involving those tubes.

Note 3. A high reading for all filaments may be due to a faulty V–1 or V–121 tube. A low voltage for all tubes may be due to the operation of the overload relay in the power supply.

Note 4. Turn off all power when replacing tubes.

57. Signal Substitution

a. General. The purpose of the signal substitution or signal tracing checks described in this paragraph is to localize trouble to a particular stage or part within the circuit group of the receiver-transmitter, which has been shown to be defective by the trouble sectionalization charts of paragraphs 52 through 55. The data obtained also serves to determine whether a particular stage or stages need alinement.

b. Test Equipment. The test equipment required for the signal tracing checks is listed in paragraph 48.

c. Test Connections. The dummy antenna load, the cabling, and the power source should be connected as described in paragraph 50 and as shown in figure 43. The connections for the test meters and the signal source are to be made as indicated in the stage gain charts included in this paragraph for the particular circuit under test.

d. Signal Tracing in Receiver. In general, the procedure of signal tracing described here consists of connecting the meter to the final output circuit of the circuit group under test, connecting the signal generator successively to each of the input circuits preceding that output connection, and for each connection of the signal generator to determine the level of the test signal required to obtain the reference reading on the meter. By comparing the values obtained with the data given in the stage gain chart, it is determined whether or not a particular stage provides the required gain. Failure to provide the required gain may be due to either a faulty component or tube within the stage or to improper alinement. The signal generator and meter connections, the required test signal frequency and the required test signals levels, and the reference readings are given stage-by-stage in the stage gain chart (*e* below).

(1) For signal tracing purposes, the receiver is sectionalized into four major groups: audio amplifier stages, fixed i-f stages (including limiters and discriminator stages), variable i-f stages (including crystal oscillator-harmonic generator, first harmonic amplifier, and first mixer).

(2) For measurements on the audio circuits, the reference reading is the nominal audio power output (100 mw) of the receiver. The l-f reference limiter meter reading is the reference level for measurements on all fixed and variable i-f circuits.

(3) The l-f reference limiter reading is obtained as follows:
Connect the meter (M–1) between terminals 5 and 1 of test socket X–200. Connect the test signal generator between terminals 6 of V–111, through a .006-μf mica capacitor, and chassis. Adjust the frequency of Signal Generator TS–588/U to 1.4 mc (use Frequency Meter Set SCR–211 for calibration of generator), and adjust the output level to .5 volt. The meter reading obtained is the l-f reference limiter meter reading and its value will be approximately .6 (volt dc); the tuned circuit, T–112, can affect the reading. To check alinement of T–112, apply the shunting unit between terminal 2 of V–111 and ground. Adjust the secondary (L–130) of T–112 (fig. 6) for maximum reading. Apply the shunting unit across terminal 6 of V–112 and chassis. Adjust the primary (L–129) of T–112 (fig. 6) for maximum reading of l-f limiter meter. It may be necessary to increase the signal generator output level to obtain a reading while performing the latter operation, due to loading by the shunting unit.

(4) The h-f reference limiter meter reading is used as a reference meter reading for measurements of the r-f circuits. The h-f limiter meter reading is obtained by performing the following steps: Connect the multimeter (M–1) between terminals 5 and 1 of test socket X–200. Connect Signal Generator TS–588/U (G–5) through a .006-μf mica capacitor to terminal 6 of tube V–107 and chassis. Adjust the signal generator frequency to 4.45 mc (TENTH MCS control at 0), and adjust the output level for an increase of the above l-f reference reading by a factor of 3. This should be approximately 1.5 volts dc. Use this reference limiter reading for all measurements of the receiver r-f and first mixer circuits.

(5) The following switch and control settings apply for all measurements on the receiver circuits:

Switch or control	Setting
SQUELCH	OFF.
DIAL LIGHT (ON-OFF) RING	OFF.
VOLUME	Maximum clockwise.
OPERATE (power supply)	RECEIVE.
TRANS POWER (power supply)	LOW.
Microphone push-to-talk button	Unoperated.
MCS and TENTH MCS dials	To correspond to test frequency used. See chart in *e* below.

e. Stage Gain Chart. Connect test Signal Generator TS–588/U (G–5) between grid of indicated stage and chassis, and connect multimeter M–1 between the terminals indicated.

Stage	Test signal		Output	
	Frequency (mc)	Input level	Meter point on X-200	Level (volts)
V-112	1.4	1.0 v	6 and 2	3.75
V-111	1.4	.5 v	1 and 5	.6
V-110	1.4	.026 v	1 and 5	.6
V-109	1.4	3,600 μv	1 and 5	.6
V-109	4.45	4,000 μv	1 and 5	.6
V-109	5.45	3,800 μv	1 and 5	.6
V-108	4.45	500 μv	1 and 5	.6
V-108	5.45	460 μv	1 and 5	.6
V-107	4.45	52 μv	1 and 5	.6
V-107	5.45	40 μv	1 and 5	.6
V-107	4.45	156 μv	1 and 5	1.5
V-107	5.45	120 μv	1 and 5	1.5
V-2	4.45	57 μv	1 and 5	1.5
V-2	5.45	29 μv	1 and 5	1.5
V-2	20.0	103 μv	1 and 5	1.5
RT-66				
V-2	27.0	140 μv	1 and 5	1.5
RT-66				
V-1	20.0	5 μv	1 and 5	1.5
RT-66				
V-1	27.0	4 μv	1 and 5	1.5
RT-66				
ANT	20.0	.4 μv	1 and 5	1.5
RT-66				
ANT	27.0	.3 μv	1 and 5	1.5
RT-66				
V-2	27.0	103 μv	1 and 5	1.5
RT-67				
V-2	38.0	140 μv	1 and 5	1.5
RT-67				
V-1	27.0	5 μv	1 and 5	1.5
RT-67				
V-1	38.0	4 μv	1 and 5	1.5
RT-67				
ANT	27.0	.4 μv	1 and 5	1.5
RT-67				
ANT	38.0	.3 μv	1 and 5	1.5
RT-67				
V-2	38.0	103 μv	1 and 5	1.5
RT-68				
V-2	54.0	140 μv	1 and 5	1.5
RT-68				
V-1	38.0	8 μv	1 and 5	1.5
RT-68				
V-1	54.0	6 μv	1 and 5	1.5
RT-68				
ANT	38.0	.7 μv	1 and 5	1.5
RT-68				
ANT	54.0	.5 μv	1 and 5	1.5
RT-68				

f. Analysis. Compare the signal generator output levels required to give the reference readings with the levels given in the chart. The tabulated data are nominal values. Nonuniformity in tubes, tolerances of components, etc., may be responsible for as much as 10 percent reading variations between sets. Interpret the test results with this fact in mind. In general, the fault in the circuit group lies between the point at which the abnormal reading is first obtained and the preceding test point. A fault may be indicated by the absence of a reading, or by a drastic reduction or increase in a reading. Refer to the schematic diagram (fig. 53, 54, or 55) to identify the stage to which the trouble has been localized. An excessively high signal generator output level required to provide the reference reading may be due to a defective tube or circuit component or to misalinement of the stage.

g. Further Trouble Localization Checks. When trouble has been traced to a given stage or a portion of the stage, do the following:

(1) Turn the OPERATE switch on the power supply to OFF, and pull the tube out of its socket.

(2) Test the tube by means of a tube checker and, if defective, replace with a good one. If a tube checker is not available, substitute a tube known to be good for the suspected one.

(3) Attempt to realine the stage or stages which show low gain, if a tube (particularly in the oscillator and h-f circuits) has been replaced (par. 71), or after a tuned stage has been extensively repaired. Realine the discriminator circuit if any part which contributes to the balance of the circuit has been replaced. If gain measurements are constantly low, and alinement fails to improve the condition, investigate the need for mechanical realinement (par. 65). Check for the possibility of broken tuning slugs, broken capacitors shafts, or loose dial detent screws.

(4) If realinement fails to clear the trouble, measure the resistances at the tube socket of the defective stage. Refer to paragraph 58 and to figures 47 and 48 for the points of measurement and the required reading. Note that the information given is merely a guide and should suggest other tests, measurements, and procedures for localizing the

trouble to a defective part or wire. Replace any component found to be defective.

(5) If the resistance measurements fail to localize the trouble, turn on the power and measure the tube socket voltages (par. 59 and figs. 47 and 48).

58. Resistance Measurements

(figs. 47 and 48. For fig. 47 see insert in back of manual.)

These checks are intended to serve as a guide for locating defective components or wiring in the stage or stages found to be defective by the signal substitution checks of paragraph 57. For these checks disconnect power from the receiver-transmitter and turn the METER switch to the RF position. Use Electronic Multimeter TS–505/U. Replace any component, or repair any wire found to be defective.

a. Make the pertinent measurements indicated in figures 47 and 48. These measurements are made from the socket terminal to ground. The required resistance readings are shown below the guide line from the socket terminal. It is not necessary to make all measurements shown in figures 47 and 48; only those indicated at the tube sockets associated with

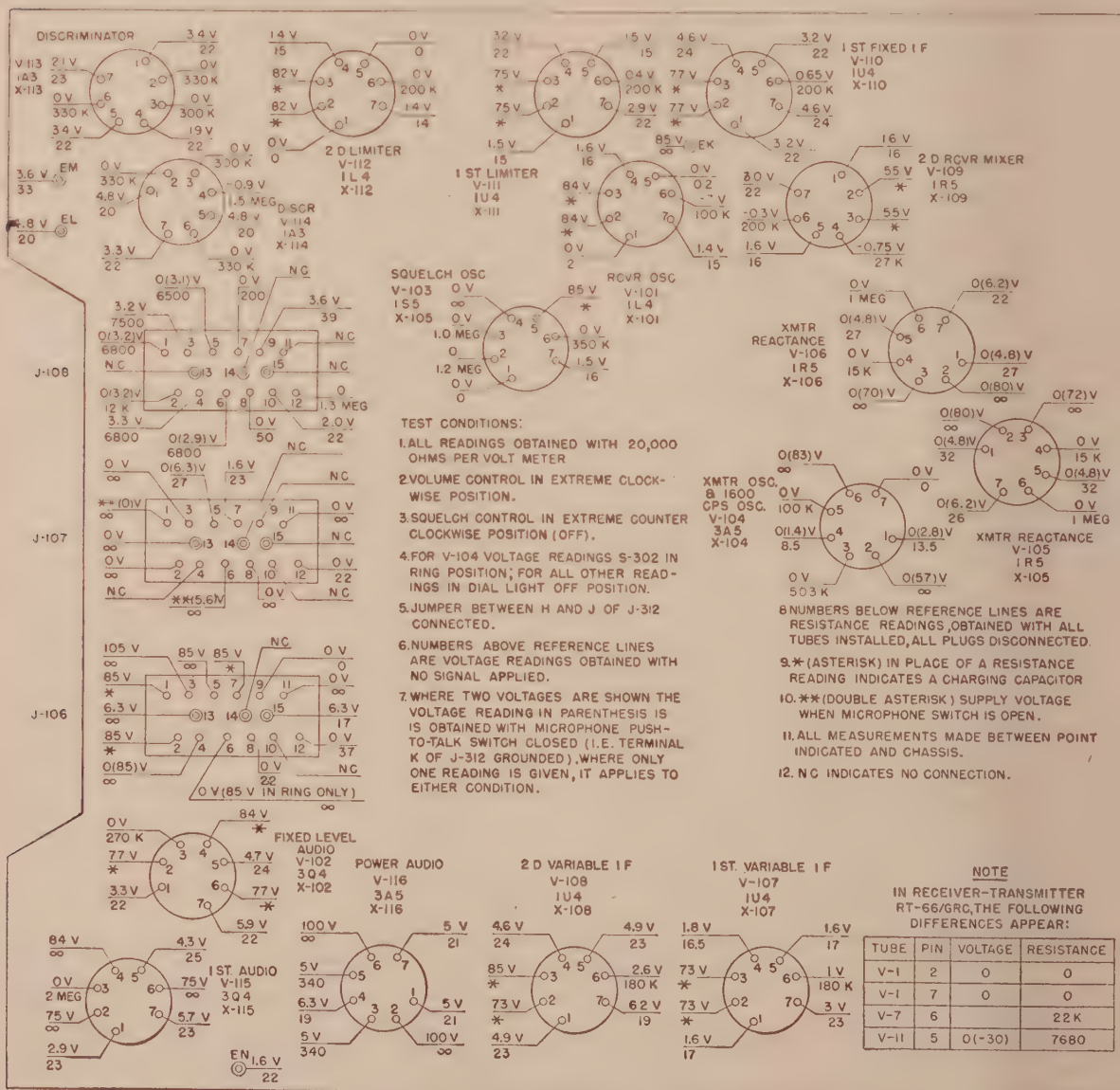
DISCRIMINATOR
2 D LIMITER V-112 1L4 X-112
1 ST LIMITER V-111 1U4 X-111
1 ST FIXED I F V-110 1U4 X-110
2 D RCVR MIXER V-109 1R5 X-109
D SCR V-114 1A3 X-114
SQUELCH OSC V-103 1S5 X-105
RCVR OSC V-101 1L4 X-101
XMTR REACTANCE V-106 1R5 X-106
XMTR OSC. & 1600 CPS OSC. V-104 3A5 X-104
XMTR REACTANCE V-105 1R5 X-105
FIXED LEVEL AUDIO V-102 3Q4 X-102
POWER AUDIO V-116 3A5 X-116
2 D VARIABLE I F V-108 1U4 X-108
1 ST. VARIABLE I F V-107 1U4 X-107
1 ST AUDIO V-115 3Q4 X-115
J-108
J-107
J-106
TEST CONDITIONS:
1. ALL READINGS OBTAINED WITH 20,000 OHMS PER VOLT METER
2. VOLUME CONTROL IN EXTREME CLOCKWISE POSITION.
3. SQUELCH CONTROL IN EXTREME COUNTER CLOCKWISE POSITION (OFF).
4. FOR V-104 VOLTAGE READINGS S-302 IN RING POSITION; FOR ALL OTHER READINGS IN DIAL LIGHT OFF POSITION.
5. JUMPER BETWEEN H AND J OF J-312 CONNECTED.
6. NUMBERS ABOVE REFERENCE LINES ARE VOLTAGE READINGS OBTAINED WITH NO SIGNAL APPLIED.
7. WHERE TWO VOLTAGES ARE SHOWN THE VOLTAGE READING IN PARENTHESIS IS IS OBTAINED WITH MICROPHONE PUSH-TO-TALK SWITCH CLOSED (I.E. TERMINAL K OF J-312 GROUNDED), WHERE ONLY ONE READING IS GIVEN, IT APPLIES TO EITHER CONDITION.
8. NUMBERS BELOW REFERENCE LINES ARE RESISTANCE READINGS, OBTAINED WITH ALL TUBES INSTALLED, ALL PLUGS DISCONNECTED.
9. * (ASTERISK) IN PLACE OF A RESISTANCE READING INDICATES A CHARGING CAPACITOR
10. ** (DOUBLE ASTERISK) SUPPLY VOLTAGE WHEN MICROPHONE SWITCH IS OPEN.
11. ALL MEASUREMENTS MADE BETWEEN POINT INDICATED AND CHASSIS.
12. NC INDICATES NO CONNECTION.
NOTE
IN RECEIVER-TRANSMITTER RT-66/GRC, THE FOLLOWING DIFFERENCES APPEAR:
TUBE | PIN | VOLTAGE | RESISTANCE
V-1 | 2 | 0 | 0
V-1 | 7 | 0 | 0
V-7 | 6 | | 22K
V-11 | 5 | 0(-30) | 7680
TM 289-59

Figure 48. Resistance and voltage data, i-f chassis.

the stage found to be defective by the signal substitution checks of paragraph 57 and the other trouble sectionalization checks.

b. Make the pertinent measurements listed in the table on the following pages. The data given in the table supplement the data given in figures 47 and 48. They cover measurements which cannot be made to ground but must be made point-to-point. The measurements also are grouped on a stage-by-stage basis, and, where this is not possible, on a functional circuit basis. It is unnecessary to make all measurements shown in the table; only those indicated for the stage or circuit found to be defective by the trouble sectionalization checks of the preceding paragraphs.

Circuit or stage	Point of measurement	Normal reading (ohms)	Probable trouble
Receiver antenna and r-f amplifier (V–1).	From ANT connector J–307 to chassis	0	Open contacts 3 and 4 of relay O–1. Defective coaxial connectors J–306 or P–6 or coaxial cable. Defective L–1.
	Across coil L–1 in tuning unit T–1	0	Defective coil L–1.
	From term. 5 to term. 6 of X–1	16,000	Defective L–2, R–4, or R–3.
	From term. 5 of X–1 to term. B of J–309.	1,000	Defective R–4, contacts 9–10 of relay O–101, multiconnector terms., or wiring.
	From term. 4 of X–1 to term. 1 of X–4	0	Defective L–7.
First receiver mixer (V-2).	From term. 3 of X–2 to term. B of J–309.	22,000	Defective R–11, contacts 9–10 of relay O–101, multiconnector terms., or wiring.
	From term. 2 (plate) of X–2 to term. 5 of T–107.	0	Defective coaxial connectors P–1 or J–101 or interchassis coaxial cable.
	From term. 5 of T–107 to term. B of J–309.	8,200	Defective L–117, R–133, multiconnector terms., or wiring.
	From term. 1 of X–2 to 7 of X–4	33	Defective R–10.
First variable i-f amplifier (V–107).	From term. 1 to term. 6 of X–107	180,000	Defective R–132.
	From term. 2 to term. 3 of X–107	0	Defective L–118.
	From term. 3 of X–107 to term. B of J–309.	12,000	Defective R–136, multiconnector terms., or wiring.
	From term. 7 of X–107 to term. 1 of X–102 (in RT–66/GRC measure from term. 7 of X–107 to chassis).	0	Defective wiring.
Second variable i-f amplifier (V–108).	From term. 6 to term. 1 of X–108	180,000	Defective R–135.
	From term. 1 of X–108 to term. 7 of X–110.	5	Defective R–148, R–149, or L–125.
	From term. 7 of X–108 to term. 7 of X–115.	12	Defective R–176.
	From term. 2 to 3 of X–108.	16,700	Defective L–119, L–121, R–137, or R–138.
	From term. 3 of X–108 to term. B of J–309.	4,700	Defective R–137, multiconnector terms., or wiring.
Second receiver mixer (V–109).	From term. 1 to term. 7 of X–109	150	Defective R–143.
	From term. 1 of X–109 to term. 7 of X–101.	0	Defective L–105 or L–106.
	From term. 2 to term. 3 of X–109.	0	Defective L–123.
	From term. 3 of X–109 to term. B of J–309.	8,200	Defective R–145.
	From term. 4 to term. 1 of X–109	27,000	Defective R–141.
	From term. 6 to term. 1 of X–109	198,000	Defective R–139 or R–140.
	From term. 7 of X–109 to term. 1 of X–115.	0	Defective L–122.
	From term. 4 of T–109 to chassis	0	Defective L–120.

Circuit or stage	Point of measurement	Normal reading (ohms)	Probable trouble
First fixed i-f amplifier (V–110).	From term. 1 to term. 6 of X–110	198,000	Defective R–146 or R–147.
	From term. 2 to term. 3 of X–110	0	Defective L–126.
	From term. 3 of X–110 to term. B of J–309.	8,200	Defective R–152, multiconnector terms., or wiring.
	From term. 7 of X–110 to term. 1 of X–108.	5	Defective L–125, R–148, or R–149.
	From term. 1 of X–110 to term. 7 of X–111.	0	Defective L–128.
First limiter stage (V–111).	From term. 1 to term. 6 of X–111	198,000	Defective R–153 or R–154.
	From term. 2 to term. 3 of X–111	0	Defective L–129.
	From term. 3 of X–111 to term. B of J–309.	8,200	Defective R–156, multiconnector terms., or wiring.
	From term. 1 of X–111 to term. 7 of X–112.	0	Defective L–131.
Second limiter stage (V–112).	From term. 2 to term. 3 of X–112	0	Defective L–132.
	From term. 3 of X–112 to term. B of J–309.	1,000	Defective R–160, multiconnector terms., or wiring.
Discriminator circuit (V–113 and V–114).	From term. 2 of X–113 to term. 2 of X–114.	0	Defective L–133 or L–134.
	From term. 2 to term. 3 of X–113	180,000	Defective R–164.
	From term. 2 to term. 3 of X–114	180,000	Defective R–165.
	From term. 2 of X–113 to term. 4 of T–113.	0	Defective L–133.
	From term. 2 of X–114 to term. 4 of T–113.	0	Defective L–134.
	From term. 1 of X–113 to term. 7 of X–114.	0	Defective wiring.
	From term. 1 of X–114 to term. 7 of X–113.	41	Defective R–162 or R–161, R–304 (or dial light), or contacts 10–11–12 of DIAL LIGHT (ON–OFF)-RING switch S–302.
	From term. 1 of X–114 to term. 7 of X–116.	0	Defective L–136.
	From term. 7 of X–113 to term. 4 of X–3.	0	Defective L–135 or L–5.
Afc circuit	From term. 3 of X–113 to term. 6 of X–105.	590,000	Defective R–170 or R–116.
	From term. 3 of X–114 to term. 6 of X–106.	590,000	Defective R–171 or R–118.
First audio amplifier (V–115).	Across R–175	270,000	Defective R–175.
	From pin 11 of P–307 to chassis	500,000	Defective R–303.
	From pin 8 of P–307 to chassis (VOLUME control in maximum counterclockwise position.)	500,000	Defective R–303.

Circuit or stage	Point of measurement	Normal reading (ohms)	Probable trouble
First audio amplifier (V–115)—Continued.	From term. 3 of X–115 to chassis	1.38 meg	Defective contacts 1–2 of relay O–101, R–173, R–174, R–109, R–110, R–55, or R–54.
	From term. 2 to term. 4 of X–115	1,500	Defective T–114.
	From term. 4 of X–115 to term. H of J–112.	0	Defective wiring or multiconnector pins.
	From term. 7 of X–115 to term. 7 of X–102.	22	Defective R–176 or R–107.
	From term. 7 of X–115 to term. 4 of X–116.	12	Defective R–176.
	From term. A of J–311 to chassis	24	Defective T–114.
Power audio amplifier (V–116).	From term. 3 to term. 5 of X–116	600	Defective T–114.
	From term. 5 to term. 1 of X–116	280	Defective T–114.
	From term. 1 to term. 7 of X–116	0	Defective wiring.
	From term. 4 of V–116 to term. L of J–309.	0	Defective wiring or multiconnector pins.
	From term. 2 to term. 6 of X–116	570	Defective T–115.
	From term. 6 of X–116 to term. M of J–309.	285	Defective T–115, multiconnector pins, or wiring.
	From term. L of J–311 to chassis	24	Defective T–115, multiconnector pins, or wiring.
Retransmit audio amplifier (V–102).	From term. 2 to term. 4 of X–102	1,500	Defective T–102.
	From term. 4 of X–102 to term. B of J–309.	100	Defective R–177, connector pins, or wiring.
	From term. 4 of X–102 to term. J of J–312.	0	Defective connector pins or wiring.
	From term. B of J–312 to chassis	24	Defective R–108 or T–102.
	Across R–106	3.9 meg	Defective R–106.
Receiver oscillator (V–101).	From term. 2 to term. 3 of X–101	0	Wiring defective.
	From term. 1 to term. 7 of X–101	150	Defective R–102.
	From term. 2 of X–101 to term. B of J–309.	50	Defective L–101, L–103, or L–104.
Crystal oscillator-harmonic generator (V–3).	From term. 1 to term. 7 of X–3	0	Defective wiring.
	From term. 4 to term. 7 of X–3	150	Defective R–14.
	From term. 3 to term. 5 of X–3	0	Defective wiring.
	From term. 2 to term. 6 of X–3	2,000	Defective R–12, R–15, or L–6.
	From term. 2 of X–3 to term. B of J–309	1,000	Defective R–12, connector pins, or wiring.

Circuit or stage	Point of measurement	Normal reading ohms	Probable trouble
First harmonic amplifier (V–4).	From term. 2 to term. 4 of X–4	5,700 to 5,850	Defective R–20, L–8, R–22, or R–21. *Note.* R–20 varies in value from 0 to 150 ohms for Receiver-Transmitters RT–68/GRC, RT–67/GRC, RT–66/GRC (fig. 19).
	From term. 4 of X–4 to term. B of J–309	4,700	Defective R–21, connector pins, or wiring.
	From term. 2 of X–4 to term. 3 of T–4	150 or 68 or 0	Defective R–20 (value depends on receiver-transmitter involved) (fig. 16).
Microphone input and reactance modulator, (V–105 and V–106).	From term. C of J–310 to term. 7 of X–106 (S–302 in OFF position).	15	Defective S–302 contacts, winding term. 6–7 of T–106, or L–137.
	Same as above (S–302 in RING position).	infinity	Defective S–302 contacts.
	Between terms. 1 and 3 of T–106	2,000	Defective T–106 winding.
	Between term. 1 of T–106 and chassis	1,000	Defective T–106 winding.
	From term. 2 of X–105 to term. 2 of X–106.	0	Defective wiring.
	From term 2 of X–105 to term. 2 of T–104.	18,000	Defective R–115.
	From term. 3 of X–105 to term. 3 of X–106.	9,400	Defective R–119 or R–120.
	From term. 3 of X–105 to term. 8 of relay O–101.	4,700	Defective R–119.
	From term. 4 of X–105 to term. 4 of X–106.	40	Defective L–114 or L–115.
	From term. 5 of X–106 to term. 7 of X–106.	22	Defective R–123.
	From term. 7 of X–106 to term. 7 of X–105.	0	Defective wiring.
	From term. 5 of X–106 to term. 1 of X–104.	19	Defective R–124 or L–116.
	From term. 7 of X–105 to term. 4 of relay O–101.	0	Defective wiring.
Transmitter oscillator (V–104A).	From term. 6 of X–104 to term. 2 of T–104.	18,000	Defective R–116.
	From term. 6 of X–104 to term. 8 of relay O–101.	0	Defective L–109 or L–111.
	From term. 2 of T–103 to chassis	0	Defective L–110.
	From junction of C–130 and L–113 and L–112 to chassis.	0	Defective L–113 or L–112.
Ringer circuit (V–104B).	From term. 2 of X–104 to term. 8 of relay O–101 (S–302 in RING position).	36,000	Defective T–105, R–129, contacts of S–302, connector pins, or wiring.
	Same as above (S–302 in OFF position).	infinity	Defective contacts of S–302.
	Across winding 1–2 of T–105	550	Defective T–105.
	Across winding 3–4 of T–105	30	Defective T–105.
	Across winding 5–6 of T–105 (S–302 in OFF position).	55	Defective T–105 or S–302 contacts.
	Same as above (S–302 in RING position).	43	Defective contacts of S–302, T–105, or T–106.

Circuit or stage	Point of measurement	Normal reading (ohms)	Probable trouble
Second harmonic amplifier (V–5).	From term. 6 of T–5 to chassis	680	Defective R–37.
	From term. 2 of X–5 to term. 3 of T–5	[1]0, 100, or 150	Defective R–24.
	From term. 3 of T–5 to term. 4 of X–5	0	Defective L–9.
	From term. 4 of X–5 to term. B of J–309 (relay O–101 unoperated).	infinity	Defective relay O–101 contacts.
	From term. 4 of X–5 to test point E–6B	470	Defective R–26.
	From term. 5 of X–5 to term. 1 of X–6	20	Defective R–25.
Transmitter mixer (V–6).	From term. 2 to term. 3 of X–6	41,420	Defective L–12, R–31, R–30, or R–29.
	From term. 3 of X–6 to stand-off insulator 7F.	41,200	Defective R–29 or R–30
	From term. 4 of X–6 to tie-point 7C	100,000	Defective R–27.
	From tie-point 7C to chassis	1,500	Defective R–37 or R–38.
	From term. 4 of V–6 to junction of J–102 and C–122.	0	Defective interchassis coaxial cable or connectors P–2 or J–102.
	From term. 7 of X–6 to term. 7 of X–8	4	Defective L–11 or L–13.
Transmitter r-f amplifier (V–7 and V–8).	From term. 2 of X–7 to term. 2 of X–8	0	Defective wiring.
	From term. 2 of X–7 to term. 3 of X–8	690	Defective L–16, R–43, or R–36.
	From term. 3 of X–8 to term. 3 of X–106	5,170	Defective R–36, R–120, multiconnector pins, or wiring.
	From term. 6 of X–7 to term. 7 of X–7. (In RT–66/GRC, from term. 6 of X–7 to chassis.)	22,000	Defective R–32.
	From term. 6 of X–8 to term. 7 of X–8. (In RT–66/GRC, from term. 6 of X–8 to chassis.)	22,000	Defective R–33.
	From term. 7 of X–8 to term. 1 of X–8	27	Defective R–35.
	From term. 7 of X–7 to term. 1 of X–7	27	Defective R–34.
	From term. 7 of X–7 to term. 7 of X–8	0	Defective wiring.
	From term. 1 of X–7 to term. 5 of X–9	7	Defective L–14.
	From term. 1 of X–8 to term. 5 of X–10	7	Defective L–15.
	From term. 7 of X–8 to term. 2 of X–11	0	Defective L–13 or L–20.

[1]For Receiver-Transmitter RT–68/GRC, RT–67/GRC or RT–66/ GRC, respectively.

Circuit or stage	Point of measurement	Normal reading (ohms)	Probable trouble
Transmitter driver (V–9 and V–10).	From term. 7 of X–9 to term. 7 of X–10	0	Defective wiring.
	From term. 7 of X–9 to term. 1 of X–10	22,000	Defective R–46, R–49, or L–18.
	From term. 3 of X–9 to term. 3 of X–10	0	Defective wiring.
	From stand-off insulator 8A to 8D	180	Defective L–18 or R–49.
	From term. 1 of X–9 to term. 1 of X–10	0	Defective wiring.
	From term. 1 of X–10 to term. C of J–309	infinity	Defective contacts 6–7 of relay O–1.
	Between test points E–7B and E–8G	6,800	Defective R–41 or test point terms.
	From term. 3 of X–10 to test point E–8G	18,000	Defective R–42.
	From test point E–7B to chassis	2,180	Defective R–37, R–38, or R–39.
Transmitter power amplifier (V–11).	From term. (plate) of V–11 to test point E–9H.	4	Defective L–22 or L–21.
	Between test points E–9H and E–9J	20	Defective R–53 or test terms.
	From test point E–9J to term. P of J–309	0	Defective wiring or multiconnector pins.
	From stand-off insulator 9M to chassis	0	Defective L–23.
	From term. 3 of X–11 to term. F of J–309	infinity	Defective contacts 4–5 of relay O–1.
	From term. 5 of X–11 to test point E–9F	5,100 (In RT–66/GRC, 1,800)	Defective L–19, R–51, or test term.
	Between test points E–9F and E–9G	1,000	Defective R–50.
	From E–9G to chassis	4,880	Defective R–40 through R–37.
	From term. 2 of X–11 to term. 7 of X–106	0	Defective L–20, multiconnector pins, or wiring.
Test circuits. (a) Test socket X–200 (i-f chassis test points).	From term. 1 of X–200 to chassis	0	Defective wiring.
	From term. 2 of X–200 to term. 4 of T–113.	1 meg	Defective R–166.
	From term. 2 of X–200 to term. 3 of X–113 or X–114.	1.18 meg	Defective R–16, R–164, or R–165.
	From term. 3 of X–200 to term. 1 of X–111.	18,000	Defective R–154.
	From term. 4 of X–200 to term. 1 of X–109	0	Defective wiring.
	From term. 5 of X–200 to chassis	18,000	Defective R–158.
	From term. 6 of X–200 to term. 3 of X–114.	0	Defective wiring.

Circuit or stage	Point of measurement	Normal reading (ohms)	Probable trouble
	From term. 7 of X–200 to chassis	38,000	Defective R–168, R–169. R–164. R–165, or R–167.
	From term. 8 of X–200 to term. 5 of X–109.	18,000	Defective R–140.
(b) R-f chassis test points.	From E–2K to chassis	120,000	Defective R–6 or test term.
	From E–2L to chassis	47,000	Defective R–8 or test term.
	From E–4H to chassis	47,000	Defective R–17 or test term.
	From E–6A to E–6B	2,200	Defective R–30 or test term.
	From E–7B to E–8G	6,800	Defective R–41 or test term.
	From E–9G to E–9F	1,000	Defective R–50 or test term.
	From E–9H to E–9J	20	Defective R–53 or test term.
(c) METER switch and associated test circuits.	From (−) term. on meter to chassis	0	Defective wiring.
	From (+) term. on meter to term. B of J–309 (METER switch in 90V position).	180,000	Defective switch contact or R–307.
	From (+) term. on meter to term. 7 of X–109 (METER switch in position 11).	6,800	Defective switch contact, R–142, multiconnector pins, or wiring.
	From (+) term. on meter to term. 1 of X–110 (METER switch in position 10).	6,800	Defective switch contact, R–150, multiconnector pins, or wiring.
	From (+) term. on meter to term. 1 of X–102 (METER switch in position 9).	6,800	Defective switch contact, R–105, multiconnector pins, or wiring.
	From (+) term. on meter to term. 7 of X–114 (METER switch in position 7).	7,500	Defective switch contact, R–163, multiconnector pins, or wiring.
	From (+) term. on meter to term. 1 of X–105 (METER switch in position 6).	12,000	Defective R–121, switch contacts, connector pins, or wiring.
	From (+) term. on meter to term. 1 of X–104 (METER switch in position 5).	6,800	Defective R–125, switch contacts, connector pins, or wiring.
	From (+) term. on meter to term. 1 of X–6 (METER switch in position 4).	6,200	Defective R–28, switch contacts, connector pins, or wiring.
	From (+) term. on meter to term. 5 of X–10 (METER switch in position 3).	6,200	Defective R–48, switch contacts, connector pins, or wiring.
	From (+) term. on meter to term. 5 of X–9 (METER switch in position 2).	6,200	Defective R–47, switch contacts, connector pins, or wiring.
Control circuits.	From term. F of J–310 to term. A of J–309 (multiconnectors P–307 and P–304 disconnected).	40	Defective coil of relay 0–301.
	From 13 of P–304 to term. 6 of P–307 (same as above).	0	Defective wiring.
	From term. 1 of P–304 to term. F of J–310 (same as above).	0	Do

Circuit or stage	Point of measurement	Normal reading (ohms)	Probable trouble
	From 13 of P–304 to term. A of J–309 (same as above).	0	Do
	From term. 1 to term. 13 of J–4	40	Defective coil of relay 0–1.
	From term. 1 to term. 6 of J–107 (same as above).	40	Defective coil of relay 0–101.
	From J–307 to J–308	0	Defective contacts of relay 0–301.
	From term. F of J–309 to term. 4 of O–1	0	Defective wiring.
	Between terms. 4 and 5 of O–1	infinity	Defective contacts of 0–1.
	Between terms. 2 and 3 of O–1	infinity	Do
	Between terms. 6 and 7 of O–1	infinity	Do
	From term. C of J–309 to term. 6 of O–1	0	Defective wiring.
	From term. 7 of O–1 to insulator 8D	0	Do
	From term. 2 to term. 3 of O–101	infinity	Defective contacts of 0–101.
	From term. 8 to term. 9 of O–101	infinity	Do
	From term. 9 of O–101 to term. B of J–309	0	Defective wiring.
	From term. 9 to term. 10 of O–101	0	Defective contacts of 0–101.
	From term. 7 of O–101 to chassis	0	Defective wiring.
	From term. 4 to term. 5 of O–101	infinity	Defective contact of 0–101.
	From term. 5 of O–101 to term. N of J–309	0	Defective wiring.
	From term. 4 of O–101 to term. 2 of X–11	0	Defective L–20 or wiring.

59. D-c Voltage Measurements

Make the pertinent d-c voltage measurements indicated in figures 47 and 48. These measurements serve to locate defects which are not readily determined by the resistance measurements of paragraph 58, that is, defective capacitors, partially-shorted transformer and coil windings, etc. For these measurements, turn the power supply OPERATE switch to the TRANS & RECEIVE position, and the TRANS POWER switch to the HIGH position. All voltage measurements shown in figures 47 and 48, except filament voltages, are made to ground. Filament voltages are measured between the terminals of the socket. Refer to the schematic diagram for the particular receiver-transmitter (fig. 53, 54, or 55) to identify the circuit components involved in a particular measurement. Note especially those circuits which are turned on or off by the operation of the microphone push-to-talk button, or the operation of the DIAL LIGHT-OFF-ON-RING switch to the RING position (par. 41). The required readings are shown above the guide lines from the socket terminals. Use electronic Multimeter TS–505/U as a voltmeter. Repair any part found to be defective as a result of the voltage measurements.

60. Check of Interunit Strapping Connections

a. The continuity checks outlined below should be made to determine whether the strapping connections between multiconnectors in the receiver-transmitter

are made properly. The strapping connections serve to tie in the receiver-transmitter with other units of the system in which it is used.

b. Using an ohmmeter (Electronic Multimeter TS–505/U or equivalent), check for continuity between the points listed below. In each case, a reading of zero ohm should be obtained. Otherwise, the wire connecting the two terminals in question is broken, or the connector pin is defective. Repair as necessary.

From terms. E and D of J–309 to chassis.
From term. J of J–309 to term. J of J–312.
From term. C of J–310 to term. C of J–312 and term. C of J–311.
From term. F of J–310 to term. F of J–311 and term. K of J–312.
From term. D of J–310 to term. D of J–311.
Between terms. J of J–310 and J–311.
Between terms. A of J–310 and J–311 and E of J–312.
From terms. H, B, and E of J–310 and J–311 to chassis.
Between terms. K of J–310 and J–311.
Between terms. L of J–310 and J–311.
Between terms. H of J–309 and J–312.
Between terms. L of J–311 and A and F of J–312.
From term. D of J–312 to chassis.

Section II. REPAIRS

61. Repacement of Parts

When replacing parts in Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC, observe the precautions given below.

a. Tagging Leads. Tagging leads is essential to assure that correct rewiring will be made when a part is replaced. Before unsoldering leads from transformers, tube sockets, panel connectors, or other parts, tie together the leads that are attached to each of these parts. With small tags or short pieces of adhesive tape, identify all wires in accordance with their numbered connections. Identify every lead that is to be removed. Refer to the schematic diagram for the particular receiver-transmitter (fig. 53, 54, or 55).

b. Parts and Substitution. When damaged parts must be replaced, identical parts should be used. If identical parts are not available and the damaged component is beyond repair, a substitution must be made. The part substituted must have identical electrical properties and must be of equal or higher voltage and current rating.

c. Positioning of Part. Relocating a substituted part may develop certain difficulties such as hum, noise, or crosstalk and is not recommended.

d. Mounting. Mount the new or replaced part in the same mounting position as that formerly occupied by the damaged part. Fasten all mounting securely.

e. Soldering. Before soldering any connection, carefully scrape all parts that will be touched by the solder until all traces of rust, corrosion, paint, or varnish are removed. Dust the scraped parts with a small clean brush. Tin all parts to be soldered. Wrap the wire around the lug to be soldered so that it is mechanically secure. Solder the connections with very little solder and use sufficient heat to make the solder flow evenly around the tinned surfaces. In the case of coaxial cables or other shielded leads, make sure the shield is soldered properly to the ground lug. The same applies to bonded connections between metal subassembly frames and the chassis plate. Make sure the ground lug is securely bonded to the chassis.

f. Retropicalization. If the parts being replaced require a special treatment such as retropicalization, follow the instructions given in TB SIG 13 and TB SIG 72.

62. Disassembly

(figs. 34 through 42)

To gain access to wiring, gears, capacitors, components mounted on the panel, or components mounted between the two chassis, it is necessary to remove either the i-f or the r-f chassis. It is preferable to remove the i-f chassis first in accordance with the procedure described in subparagraph *a* below. Under certain conditions, especially if parts are to be replaced on the panel or on the r-f chassis, it is desirable to remove the r-f chassis next in accordance with the procedure outlined in *b* below.

Caution: Be very careful in going through the disassembly procedure. The assembly is rather intricate and the parts, especially the gears and the capacitor assemblies, are delicate. Careless handling may cause damage to the gears, to the toothed crowns on the couplings, or to other parts. Side pressure on

couplings may break a ceramic shaft on a gang capacitor.

a. Removal of I-F Chassis. To disengage the i-f chassis from the rest of the assembly, proceed as follows:

(1) Rotate the TENTH MCS and MCS controls (fig. 1) to their lowest frequency settings.

(2) Withdraw multiconnectors P–306, P–307, and P–308 from J–106, J–107, and J–108, respectively. These connectors, located on the i-f chassis near the panel, serve to join the panel-mounted components to the i-f chassis circuits (fig. 39). Pull at the handles in the direction perpendicular to the chassis. Be careful not to break any wires or to damage the connectors or any of the soldered parts.

(3) Disengage the toothed couplings which join the TENTH MCS control shaft which extends into the interior of the set from the dial-drive assembly, to the gang capacitor shaft on the i-f chassis, as follows: Place the unit in its normal operating position. Using a screw driver or similar convenient tool, rotate the long finger of the *spider* as far as it will go (fig. 11). The spider is a flat washer with three long and three short fingers radiating out of its center. It is located between the bellows and the toothed crown of the coupling. Rotating the spider disengages the short fingers from the slots in the small posts which project through the toothed crown.

(4) Remove the back plate (fig. 34) as follows: Remove the four screws which hold the back plate to the T-shaped spacers between the two chassis. Loosen the four large captive bolts which hold the back plate to the i-f and r-f chassis. These bolts are located in the rear corners of the chassis. Remove the back plate.

(5) Disengage the two coaxial plugs associated with the coaxial cables extending from the r-f to the i-f chassis. These are connectors P–1 and J–101 which join the receiver first mixer plate (V–2) to tuning assembly T–107, and connectors P–2 and J–102 which join the transmitter oscillator (V–104A) output to the transmitter mixer (V–6) input (fig. 4). These connectors are mounted on small brackets at the rear of the i-f chassis.

(6) Remove the two large machine screws which hold the i-f chassis to the projections on the rear of the front panel.

(7) Spread the rear ends of the chassis slightly to remove the spacers.

(8) Very carefully lift the i-f chassis away from the rest of the assembly, taking care not to strip the gear teeth or to bend the chassis out of shape.

b. Removal of R-F Chassis. To disengage the r-f chassis from the panel, proceed as follows:

(1) Withdraw multiconnectors P–304 and P–305 from plugs J–4 and J–5, respectively (figs. 35 and 36). These connectors are located on the r-f chassis near the panel. Pull at the handles in a direction perpendicular to the chassis.

(2) Loosen, but do not remove the No. 6 screw (terminal 9M) on the bracket which is mounted on the ceramic post on the r-f chassis below the transmitter antenna tuning capacitor (figs. 34 and 37). Withdraw the spade lug. This lug is connected to a bead-covered wire which joins the antenna relay contacts to the antenna circuit of the transmitter.

(3) Pull out the flexible shaft (fig. 4) from the coupling collar mounted on the shield for TRANS ANT COUPLING coil L–23.

(4) Disengage connector P–6 from J–306 (fig. 34). These coaxial connectors join the coaxial cable from the antenna relay contacts to receiver antenna circuit L–1.

(5) Loosen the two No. 6 setscrews on the coupling collar of the worm-gear assembly that varies capacitor C–1A (fig. 36). Use the No. 6 Allen wrench. The Allen wrenches are mounted in a spring clip on the r-f chassis. Disengage the flexible shaft from the coupling collar.

(6) If the back plate and the spacers have not been removed yet, perform the operations indicated in *a*(4) and (5) above.

(7) Turn the spider on the coupling between the MCS control and r-f gang capacitor C–17 (fig. 11) to disengage the toothed couplings. Similarly, disengage the coupling between the dial-drive assembly and

the crystal oscillator-harmonic generator ganged capacitor C–1.

(8) Remove the two large machine screws which hold the r-f chassis to the projections on the rear of the front panel.

(9) Lift off the r-f chassis, being careful not to cause any damage to the gears, couplings, or gang capacitor shafts.

63. Reassembling the Equipment

To reassemble the equipment, follow the reverse of the procedure for disassembling the unit as described in paragraph 62. The recommended order is to attach the r-f chassis to the front panel first. After that is done, attach the i-f chassis to the panel. Reconnect all connectors and attach the spacers and the back plate. This procedure is outlined below.

a. R-F Chassis. (1) Set the MCS dial at its lowest detent setting. Set the TENTH MCS dial at 0. Turn the TRANS ANT COUPLING control to the extreme clockwise position.

(2) Place the front panel face down. Line up the gears of the capacitor on the r-f chassis so that the red lines on the faces of the gears touch each other and form a straight line. This keys the gear assembly and the couplings to the coupling on the dial-drive assembly.

(3) Visually line up the chassis over the front panel and drop it in place so that the projections on the chassis fall to the right of the projections from the rear of the front panel. Shift the chassis back and forth, a little at a time, until the toothed-crown couplings engage, and the small studs on the toothed crown of the coupling attached to the dial-drive mechanism fit through the three holes in the corresponding crown of the coupling on the capacitor shaft. The studs on the toothed crown of the coupling on the dial-drive mechanism are keyed with the holes in the crown of the capacitor coupling so that they will fall in place in one position only. If necessary, shift the r-f chassis back and forth slightly to achieve proper alinement of the studs with the holes.

(4) Insert and tighten the two screws holding the front and the r-f chassis together. Slightly shift the r-f panel back and forth as required to take all bends out of the flexible coupling. Tighten the screws.

(5) Using a small screw driver, finger, or other suitable means, turn the spider between the toothed crown and the bellows of the capacitor coupling so that the short fingers on the spider engage the slots on the studs from the crown on the dial-drive mechanism coupling.

(6) Reconnect the spade lug on the beaded lead from the antenna relay to the ceramic post (terminal 9M) in the r-f chassis.

(7) Reinsert the shaft of the flexible coupling from the REC ANT TUNE control in the shaft of the worm-gear coupling. Tighten the two setscrews on the worm-gear coupling.

(8) Reconnect multiconnectors P–305 and J–5 and P–304 and J–4.

(9) Reinsert the flexible coupling from the TRANS ANT COUPLING control into the bushing associated with the transmitter coupling coil in T–9. The shaft of the flexible coupling is slotted. See that the shaft falls into the bushing properly. If this cannot be done, rotate the flexible shaft slightly until movable antenna coil L–23 is parallel with fixed tank coil L–22 (fig. 49) and the slot engages the key inside the bushing.

b. I-F Chassis. Aline the gears on i-f gang capacitor C–101 so that the marks on the gear faces form a straight line. Drop the i-f chassis in place so that the projections from the shaft are on the left side of the projections from the rear of the panel. Make sure that the crown couplings on the capacitor shafts line up with the toothed-crown couplings from the dial-drive assembly. Turn the spider to engage the slots on the studs to lock the couplings together. Screw the chassis firmly to the back of the front panel. Reconnect the two coaxial cables, P–1 and P–2, from the r-f to the i-f chassis. Reconnect the three multiconnectors P–306, P–307, and P–308.

c. Spacers and Back Plate. Slightly back off the screws which hold the i-f chassis to the front panel. Spread the rear ends of the two chassis enough to permit insertion of the T-shaped spacers. Make sure that the tabs on the spacers fall in the

slots on the r-f and i-f chassis. Before reattaching the back plate, reinsert the crystals in the crystal-holder assembly at the rear of the r-f chassis. A label in the cover for that assembly shows where the various crystals are to be plugged in. Place the back plate in position and insert and tighten the four screws which hold the back plate to the spacers. Tighten the four large captive bolts located in the corners of the chassis. Reinsert all tubes, making sure that the tubes are seated firmly in their sockets. In the case of power amplifier tube V–11, attach the ceramic plate cap. Replace all tube shields.

64. Special Repair Procedures
(figs. 34 through 42, 49, and 50)

Most of the parts in the receiver-transmitter are readily accessible and can be replaced without special procedure instruction. Most of the small components, namely resistors, small capacitors, and small choke coils, are wired point to point directly to the lugs of sockets and terminals of tuning units. In replacing these parts, be careful not to damage adjacent components. Special procedures for repairing or replacing sockets, connectors, and some of the more complicated subassemblies, are given in the following subparagraphs. Since the unit is very compact and many of the components are sandwiched in between the i-f and r-f chassis, it will be necessary to disassemble the unit as described in paragraph 62 before the mechanical repair and replacement procedures described below can be followed. In many cases, disassembly of the unit, before the part is replaced, will prevent damage to other parts. It is a matter of judgment to decide when it is necessary to disassemble the unit and when it is possible to do the replacement without disassembly.

a. Sockets. All tube sockets are attached to the chassis with rivets. To replace a socket, proceed as follows:

(1) Disassemble the particular chassis from the rest of the unit to prevent possible damage by the tools used in removing the part.
(2) Remove the tube shield and the tube plugged into the socket.
(3) Unsolder the wires connected to the socket.
(4) Drill out the two rivets fastening the socket to the chassis.
(5) Substitute a new socket and fasten it with machine screws, lock-washers, and nuts, or, if feasible, with rivets. Make sure that the socket is keyed the same way as the socket which was removed.
(6) Resolder the wires and components to the socket.
(7) Clean the chassis thoroughly to remove solder drops or metal chips.
(8) Check the new connections with those shown on the schematic diagram for the particular unit (fig. 53, 54, or 55).

b. Stand-Off Insulators. Stand-off insulators are riveted to the chassis. To remove, unsolder the leads attached to the insulator and drill out the rivet.

c. Panel Connectors. To remove panel connectors, it is necessary to disengage the panel from the rest of the panel and chassis assembly. A spanner wrench or a pair of long-nosed pliers is necessary. Proceed as follows:

(1) Disengage the panel from the rest of the assembly to gain access to the rear of the panel. Insert the teeth of the spanner wrench into the notches in the nut of the connector on the front panel. Turn the spanner wrench in the counterclockwise direction until the nut is removed. Remove the lockwasher.
(2) Unsolder all wires.
(3) Remove the connector from the rear of the panel.
(4) In selecting a new connector make sure that the new part has a rubber gasket.
(5) Resolder all wires to the new connector.
(6) Clean thoroughly to remove solder drops.
(7) Recheck the new connections with those shown in the schematic diagram for the particular unit (fig. 53, 54, or 55).
(8) Reinsert the connector from the rear of the panel.
(9) Reinsert the lockwasher and the nut by using the spanner wrench.
(10) Screw the nut back on to the connector. Check the assembly for tightness.
(11) Reassemble the panel to the rest of the unit.

d. Replacement of R-F Coils. The r-f coils of both the transmitter and the receiver are located in the compartments of an assembly mounted on the wiring side of the r-f chassis. Proceed as follows:

(1) Disassemble the r-f chassis from the rest of the panel and chassis assembly as described in paragraph 62*b*. Place the r-f chassis with the wiring side up.

(2) Remove the four machine screws which hold the cover of the coil compartment in place. Remove the cover. The partition separating the r-f coils from each other is now exposed to view (figs. 37 and 38).

(3) Remove the six machine screws, nuts, and lockwashers which hold the partition to the vertical frames of the r-f compartment. Three of these screws are located on one frame and three on the other.

(4) Remove the two machine screws, nuts, and lockwashers which hold the partition to the chassis plate.

(5) Remove the partitions. The coils now are more accessible.

(6) To replace any one of the r-f coils, proceed as follows:

(*a*) Unsolder the leads. In doing this, be careful not to damage the delicate coil windings.

(*b*) Unscrew the large nut located on the outer side of the compartment frame. In doing this, be sure not to lose the small spring clip which grips the tuning slug to the nut. This clip insures that the tuning slug holds its adjustment.

(*c*) Remove the coil.

(*d*) Insert the replacement coil.

(*e*) Resolder all connections and restore the nut and tuning slug assembly. Make sure that the spring clip is in place, otherwise the tuning slug will get loose and come out of adjustment easily.

(7) Coils L–17 and L–18, trimmer capacitors C–66 and C–68, and resistor R–49 are mounted as an assembly on a bakelite board which in turn is mounted by two machine screws on the compartment frame. To replace this assembly proceed as follows:

(*a*) Unsolder the leads from the two gang capacitor lugs.

(*b*) Remove the two machine screws, lockwashers, and nuts holding the bakelite base to the frame.

(*c*) Unsolder the leads from the board to the stand-off insulators around it.

(*d*) Carefully withdraw the assembly from compartment wall, making sure not to damage any of the components mounted on the r-f chassis plate.

(*e*) To replace the assembly, reverse the above procedure.

(8) The antenna coupling coil and associated components are mounted as a subassembly at the front end of the r-f coil assembly. To replace this subassembly, proceed as follows:

(*a*) Remove the cap from the plate of tube V–11. Unsolder the lead from the feed-through insulator on the bracket of the subassembly.

(*b*) Unsolder the wire between the capacitor lug and the lug on the insulator within the assembly.

(*c*) Disconnect the leads to the gang capacitor lug.

(*d*) Turn the shaft of the coupling coil so that the movable winding is as far away from the fixed winding of the coil as possible. This will give access to one mounting screw.

(*e*) Return the movable coupling coil to its position as close as possible to the fixed coil and remove the other mounting screw. The entire subassembly now can be removed.

(*f*) Lift the subassembly away from the chassis (fig. 49).

(*g*) To replace the subassembly, reverse the procedure outlined above.

e. Replacement of Variable Gang Capacitor C–1. Variable gang capacitor C–1 is mounted on the component side of the r-f chassis. To replace the capacitor, it is necessary to remove the r-f chassis from the rest of the assembly and proceed as follows:

(1) Turn the unit, wiring side up, and remove the r-f compartment cover.

(2) Remove the r-f compartment parts as described in *d* above.

(3) Unsolder all the leads from the capacitor lugs projecting through holes in the chassis plate into the r-f coil compartment.

(4) Turn the unit component side up.

(5) Remove the two screws at the front end of the capacitor and the one screw at the

the rear of the capacitor which hold capacitor C–1 to the chassis.

(6) Lift the capacitor off the chassis.

Caution: Do not remove gears from the capacitor shafts.

(7) If the capacitor is to be replaced, remove the crown coupling and bellows by loosening the setscrews on the coupling collar, using an Allen wrench.

(8) Remove the variable cam assembly by loosening the Allen setscrews on the cam assembly shaft using an Allen wrench. Two such setscrews hold the cam assembly to the capacitor shaft.

(9) Inspect the crown coupling and the cam assembly to see whether or not they are damaged before replacing them on the capacitor to be installed in place of the unit removed by the above procedure. To reinstall the capacitor, proceed as follows:

(*a*) Place the repaired or new capacitor on the r-f chassis so that the holes in the mounting brackets at the front and rear of the capacitor line up with the corresponding holes on the chassis plate.

(*b*) Insert and tighten the three mounting screws.

(*c*) In placing the capacitor on the chassis, make sure that the large gear clears the cut out provided for on the chassis plate. Be sure that the capacitor lugs clear the holes on the chassis plate.

(*d*) Turn the chassis, wiring side up, and reconnect all solder connections to the capacitor lugs, making sure that the proper connections are made.

(*e*) Replace the cam arrangement on the shaft at the top of the capacitor.

(*f*) Tighten the two setscrews which hold the cam to the capacitor shaft.

(*g*) Replace the crown coupling over the capacitor shaft associated with the large gear. Tighten the two setscrews.

(*h*) Rotate the cam to make sure that the finger on the antenna tuning capacitor rides over the cam links and is not caught between the two extreme adjustment screws on the cam assembly.

f. Replacement of Variable Capacitor C–7. The procedure for replacing the harmonic generator tuning capacitor C–7 is as follows:

(1) Turn the r-f chassis wiring side up.

(2) Disconnect all leads joining the capacitor to the components on the chassis.

(3) All connections are made on the two ends of the capacitor.

(4) Turn the capacitor gears so that the green Allen head setscrews become accessible through the r-f coil compartment (after the cover for that compartment has been removed). Using an Allen wrench, release the green setscrews. Do not touch the setscrews painted red.

(5) Pull out the brass shaft projecting from the front of the chassis to the shaft of the large gear on the capacitor.

(6) Turn the chassis component side up and remove the three mounting screws. Two of these mounting screws are located between capacitor C–1 and the crystal switch assembly. The third one is at the rear of the crystal switch assembly. If necessary, remove the crystal switch cover to remove this screw. Carefully move the capacitor toward the rim of the chassis sufficiently to clear the coupling collar from the r-f coil compartment and lift the capacitor off the chassis. Be careful not to damage the gears or the components mounted on the chassis. Replacement of the capacitor involves retracing the steps outlined above in the reverse order.

(7) Place the capacitor on the chassis so that the large gear clears the slot cut out for it on the chassis plate.

(8) Line up the capacitor so that the holes in the three mounting feet line up with the holes on the chassis plate.

(9) Reassemble the capacitor to the chassis by means of the screws, nuts, and lockwashers.

(10) Reinsert the brass shaft into the coupling collar and tighten the Allen setscrews.

(11) Reconnect all wires and parts to the capacitor. Check against the schematic diagram for the particular unit (fig. 53, 54 or 55) to make sure that the connections have been made correctly.

g. Antenna Tuning Capacitor Assembly. To remove this capacitor and the tuning subassembly mounted on it, proceed as follows:

(1) Remove the r-f chassis from the rest of the assembly and place it wiring side up.

(2) Unsolder the lead from the lug on the ceramic insulator.

(3) Using a hex wrench remove the four nuts from the capacitor mounting studs.

(4) Lift the capacitor off the component end of the chassis. When replacing this capacitor, reverse the above procedure, making sure that the finger on the lever rides over the cam assembly links and is not caught between the two extreme adjustment screws. Make sure also that the spring is attached between the stud on the capacitor bracket and the stud on the lever attached to the pinion gear. Make sure that the pinion gear is firmly seated on the capacitor shaft. For that purpose, tighten the setscrews which hold the pinion gear to the capacitor shaft.

h. Replacement of Components in Tuning Unit Cans. The tuning units on the r-f and i-f chassis are mounted by means of two studs (part of the tuning unit assembly) and two nuts. To replace the unit as a whole, unsolder leads and remove the two nuts on the wiring side of the chassis. To gain access to components within the can, remove the two screws at the top of the can which hold the cover to the assembly. Lift off the cover.

i. Crystal Switch Assembly. The crystal switch assembly is mounted at the rear of the r-f chassis (fig. 36).

(1) To gain access to the crystals, remove the back plate of the panel and chassis assembly.

(2) Remove the two screws which hold the crystal switch assembly cover in place. The crystals now are exposed to view and may be replaced simply by plugging a new crystal into the socket.

(3) To remove the assembly, unsolder the wire connected to the feedthrough terminal on the side of the assembly. Remove the four screws, two on each side, which hold the crystal switch assembly mounting brackets to the r-f chassis.

(4) To gain access to the switch, remove the four screws at the front of the assembly and pull the crystal mounting bracket away from the switch compartment.

(5) Before replacing the assembly, line up the two gears so that the markings on each touch each other and form a straight line.

(6) Inspect the switch to make sure that the arm rests on the first switch contact.

(7) Insert the crystal mounting plate in the compartment and restore the four screws which hold the crystal plate to the compartment.

(8) Place the assembly over the chassis so that the four mounting holes line up with the corresponding holes on the chassis.

Note. Make sure that the idler (lower gear) meshes with the large gear protruding through the chassis plate.

(9) Replace and tighten all mounting screws.

(10) Replace the crystals and the crystal switch assembly cover.

(11) Resolder the wire to the feedthrough terminal on the side of the assembly.

j. Relay O–1. Relay O–1 is mounted at the top of the front panel by means of a mounting bracket and two screws. To remove the relay proceed as follows:

(1) Disengage the panel from the rest of the equipment (fig. 35).

(2) Remove the spade lug on the beaded wire from the ceramic insulator on the r-f chassis.

(3) Unsolder all leads from the relay.

(4) Remove the two mounting screws.

(5) Use a relay spring bender to aline the relay contacts. The relay contacts are alined properly when moving the armature causes the moving contact and the contact furthest away from the body of the relay to close, and when releasing the armature causes the moving contact and the contact nearest to the body of the relay to close.

(6) Use a contact burnisher to clean contacts thoroughly.

(7) Wipe off with a clean lintless cloth.

(8) Use a relay spring bender to straighten out all bent or warped contact springs.

(9) If the relay is damaged beyond repair and replacement is necessary, remove the two screws which mount the relay to the panel. Lift the relay off the chassis and disconnect all wires.

(10) Before mounting the relay, reconnect all wires.

(11) Make sure the contacts on the new relay are alined properly as described above.

(12) Mount the relay to the panel using the two screws and lockwashers.

k. METER. The meter is mounted to the front panel by means of the four screws on the face of the meter. To remove the meter, proceed as follows:

(1) Remove the two nuts on the back of the meter to remove the wiring.

(2) Remove the four screws on the face of the meter. The meter now will slip through the front of the panel. Remove the rubber gasket.

Note. To remove the meter, it is not necessary to disconnect the assembly.

l. DIAL-DRIVE MECHANISM. To replace the dial-drive mechanism, it is necessary to remove the front panel from the rest of the assembly. Proceed as follows:

(1) Remove the two large screws which hold the knobs to the dial-drive mechanism shaft on the front panel.

(2) Remove the knobs and the stops.

(3) Remove the 14 screws which hold the dial plate to the panel.

(4) Remove the dial plate.

(5) Remove the five mounting screws on the rear of the panel which hold the projection from the dial-drive mechanism to the panel.

(6) Remove the dial lamp assembly by removing the two screws which hold it to the dial drive.

(7) Remove the O ring rubber seals, the retainer ring, and spring washer from each shaft.

(8) Lift the dial-drive mechanism off the rear of the panel. To replace, reverse the above procedure, making sure that the O ring seal is not damaged.

m. REPLACEMENT OF DIAL LAMP. To replace the dial lamp, simply remove the two screws which hold the dial lamp cover to the dial plate. This will give access to the dial lamp assembly and to the dial lamp. The lamp is held in a spring clip type socket (fig. 1Z).

n. SWITCHES. The panel-mounted switches may be removed as follows:

(1) Disconnect the panel from the rest of the assembly.

(2) Unsolder all wires from the switch, making sure to tag the leads to enable proper replacement.

(3) Remove the switch knob.

(4) Remove the castellated nut using a spanner wrench.

(5) The switch now can be removed from the rear of the panel.

(6) When replacing the switch, examine contacts to be sure they are made properly and that the switch shaft turns freely.

(7) Reinsert the switch so that the key fits into the hole provided for it on the back of the panel.

(8) Restore the mounting nut and the knob.

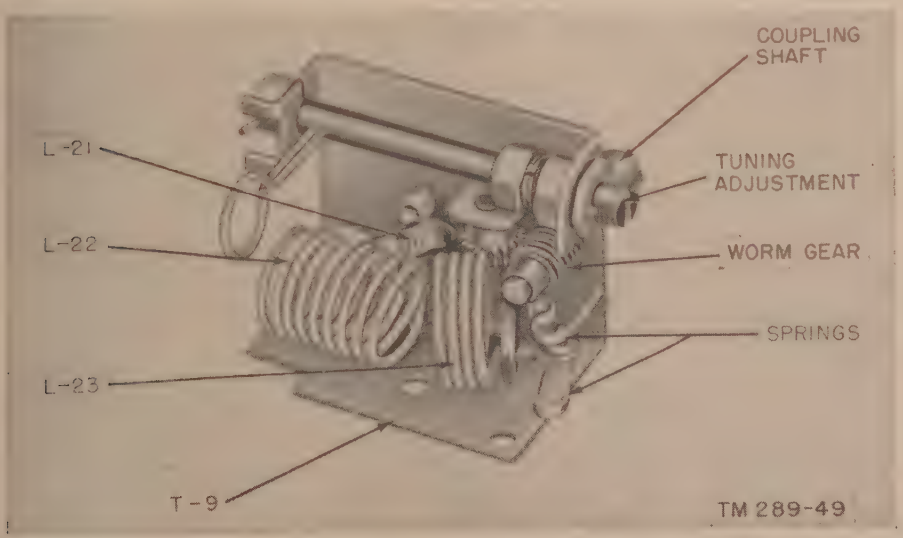

Figure 49. Transmitter antenna coupling assembly. In Receiver-Transmitter RT-66/GRC, L-21 does not appear on this assembly.

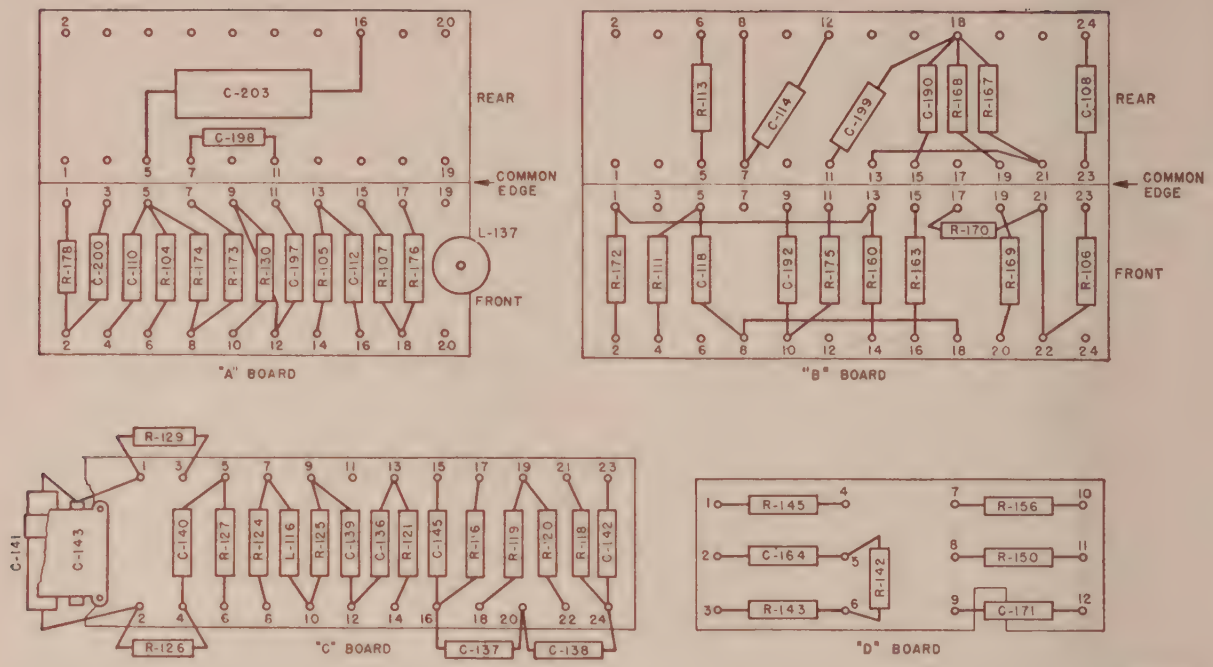

Figure 50. Terminal boards, component location diagrams.

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65. Mechanical Alinement Procedure for Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC

a. After assembling the r-f chassis on to the front panel by securing and locking the two couplings to the panel and tightening the two screws on either side of the r-f chassis, the r-f chassis is alined mechanically in the following manner:

(1) Loosen the two yellow-headed No. 10 Allen setscrews which connect the coupling to the main tuning capacitor (C–1). With both the MCS and TENTH MCS dials set at their lowest frequency settings, adjust the gears on capacitor C–17 so that the two lines, which are inscribed on two of its gears, form a straight line. Tighten the two Allen setscrews as tight as possible.

(2) Loosen the two yellow-headed No. 8 Allen head setscrews on the transmitter antenna tuning cam. Rotate the cam clockwise (looking from the front) until the shaft resting upon the cam is set on the first pin. For the fine adjustment, push in the TRANS ANT TUNE wrench and rotate the cam slightly until the hex head of the antenna tune wrench fits into the first cam adjustment screw. While in that position, tighten the two yellow-headed Allen head setscrews.

(3) To get the proper spring tension on the spring connected between the antenna tuning capacitor housing (C–74) and the gear connected to the antenna tuning capacitor, loosen the two yellow-headed No. 6 Allen head setscrews which connect the arm gear to C–74. Lift the arm gear to disengage the segment gear. Adjust the spring tension and then reengage the teeth of the arm and segment gears. Leave the setscrews loose until the final alinement of the transmitter.

(4) To adjust the harmonic generator capacitor (C–17) remove the tube type 2E24 (V–11) so that the two No. 8 yellow-headed Allen head setscrews on the coupling to the 3/16-inch shaft may be loosened. After they are loosened, check dials to be sure that they are at their lowest frequency settings and adjust the gears on the harmonic generator capacitor until the four inscribed lines (one on each of the lower gears and two in the top gear) form two straight lines. Tighten the two yellow-headed No. 8 Allen head setscrews.

(5) To adjust the crystal switch remove its cover. Loosen the two yellow-headed No. 6 Allen head setscrews which connect the gear to the back shaft coming out of the switch box. Before final adjustment, make

sure there is no backlash in the gear that is attached to the shaft that is coming out of the switch box. If there is backlash, loosen the two ¼-inch hex head screws holding the idler gear and adjust the gear until there is no noticeable backlash. Next, remove the crystal which is located in the upper right-hand corner of the box and place one head of a low resistance measuring ohmmeter in the outer jack. Connect the other side of the ohmmeter to the feed through insulator stamped 3J. Rotate the back shaft with the aid of a pair of long-nosed pliers, until there is zero resistance registered on the meter. Carefully tighten the two yellow-headed No. 6 Allen head setscrews and replace the crystal and back cover. The r-f chassis then is mechanically alined.

b. After assembling the i-f chassis on to the front panel by securing and locking the coupling to the panel and tightening the two screws on either side of the i-f chassis, the i-f chassis then is mechanically alined in the following manner:

(1) Loosen the two yellow-headed No. 8 setscrews on the coupling which connects the ⅜-inch shaft.

(2) With the panel set on zero kc, adjust the gears on the capacitor so that the two lines, which are inscribed on its two gears, form a straight line.

(3) Tighten the two Allen head setscrews.

Section III. LUBRICATION AND WEATHERPROOFING

66. Lubrication

Receiver-Transmitters RT–66/GRC, RT–67/-GRC, and RT–68/GRC do not require lubrication in the field. Certain parts are self-lubricated. Included in this category are the dial-drive mechanism, gears, and O-ring seals on shafts of panel-mounted components. Do not attempt to oil or grease any of these parts, since this would require disassembly. Normally, this equipment must not be disassembled in the field.

67. Weatherproofing and Rustproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions, such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moisture-proofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is fully explained in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are fully explained in TB SIG 66.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust, are fully explained in TB SIG 75.

e. Rustproofing. Rust and corrosion can be prevented by touching up bared surfaces. Clean where necessary with fine sandpaper. Never use steel wool.

Note. For further information on general preventive maintenance techniques, refer to TB SIG 178.

68. Refinishing

a. When the finish on the case or on the panel has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish. Instructions for refinishing badly marred panels and cases are given in TM 9–2851.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases, it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

69. Test Equipment Required for Alinement

The test equipment required for alinement of the receiver-transmitter is the same as that listed in paragraph 48.

70. Initial Procedures

a. Initial Switch and Control Settings. Unless otherwise specified, the controls should be set as follows:

Control	Position
SQUELCH	OFF.
VOLUME	Extreme clockwise maximum gain.
DIAL LIGHT (ON-OFF)-RING	OFF.

b. Test Connections. Unless otherwise called for under the alinement procedures (pars. 71 and 72), the test connections are the same as described in paragraph 50.

71. Receiver Alinement

a. Discriminator Alinement.

(1) Connect RF Signal Generator SG–20/U (G–4) in series with a .006-μf capacitor between the grid (pin 6) of the second limiter tube, V–112, and chassis. Connect meter M–1 between terminals 7 and 1 of test socket X–200. Hereafter, this meter will be referred to as the *discriminator meter*.

(2) Adjust the frequency of the signal generator, calibrated with Frequency Meter Set SCR–211 (M–4), to 1.4 mc, and adjust its output level to 1 volt rms (root mean square) or more.

(3) Adjust the tuning slug marked S (secondary) on L–133 and L–134 (fig. 6) on discriminator tuning unit T–113 until the discriminator meter reads zero.

(4) Connect meter M–1 between terminals 2 (+) and 6 (—) of X–200. This meter will be referred to as the *alinement meter*.

Note. In the above procedure, two meters are needed. Actually, the same meter may be used as the discriminator meter and as the alinement meter. If separate meters are used for the two test positions, make sure to disconnect the first meter before using the second meter.

(5) Adjust the tuning slug marked P (L–132) on T–113 (fig. 6) until a peak reading is obtained on the alinement meter.

(6) Change the frequency of the signal generator to a calibrated 1.43 mc.

(7) Observe the discriminator meter (pins 7 and 1 of X–200) reading and note the polarity of the reading (that is, whether it is to the right or to the left of zero).

(8) Change the frequency of the signal generator to a calibrated 1.37 mc, and again observe the discriminator meter reading and the polarity of that reading. The readings obtained in (7) and (8) above should be nearly equal, and should be of opposite polarity. The difference between the two readings should not be greater than .6 volt.

(9) Repeat (2) through (8) above as many times as is necessary to meet the requirements in (8) above.

(10) Retune the signal generator to 1.4 mc and readjust the tuning slug marked S on T–113, L–133, and L–134 (fig. 6), to obtain a zero deflection on the discriminator meter.

b. Fixed i-f Amplifier. The following alinement procedure, if followed carefully, will result in a properly alined, fixed i-f amplifier circuit. This procedure is recommended for receivers known to be completely out of alinement, or for receivers where the alinement status is not known. If only partial, or *touch-up* alinement is needed, proceed as indicated in ¶(19) below.

(1) Reconnect the signal generator (G–5) in series with the .006-μf capacitor between the grid (terminal 6) of first limiter tube V–111 and chassis.

(2) Connect the limiter meter (terminals 5 and 1 of X–200) and the discriminator meter (terminals 7 and 1 of X–200).

(3) Temporarily disable the receiver oscillator by connecting a .006-μf capacitor between the plate (terminal 2) of oscillator tube V–101 and chassis.

(4) Adjust the signal frequency to 1.4 mc (zero reading on discriminator meter), and adjust the level to .5 volt rms.

(5) Connect a temporary shunting unit between

the plate (terminal 2) of first limiter tube V–111 and chassis. The shunting unit is composed of the series arrangement of a .006-μf capacitor and a 2,700-ohm resistor.

(6) Tune the slug marked S of secondary coil L–130 (fig. 6) in tuning unit T–112 until the limiter meter shows a peak reading.

(7) Shift the connection of the shunting unit between the signal grid (pin 6) of V–112 and chassis.

(8) Tune the slug marked P of primary coil L–129 (fig. 6) in tuning unit T–112 until the limiter meter shows a peak reading. Remove the shunting unit. With the signal generator output of .5 volt, the limiter meter reading should be approximately .6 volt dc. This value will be known as the l-f (low-frequency) reference limiter meter reading (par. 57*d*(3)).

(9) Shift the signal generator connection to the grid (pin 6) of first fixed i-f amplifier tube V–110. Adjust its frequency to 1.4 mc and adjust its output to obtain the l-f reference limiter meter reading.

(10) Connect the shunting unit to the plate (terminal 2) of the first fixed i-f amplifier stage V–110.

(11) Adjust the input injection signal to the l-f reference limiter meter reading. Tune the slug marked S of secondary coil L–127 (fig. 6) in tuning unit T–111 until the limiter meter shows a peak reading.

(12) Shift the connection of the shunting unit to the grid (pin 6) of first limiter tube V–111.

(13) Tune the slug marked P of primary coil L–126 (fig. 6) in tuning unit T–111 until the limiter meter shows a peak reading.

(14) Shift the signal generator connection to the signal grid (pin 6) of second receiver mixer tube V–109, and adjust its frequency and output level as before.

(15) Shift the shunting unit connection to the plate (pin 2) of V–109.

(16) Tune the slug marked S of secondary coil L–124 (fig. 6) in tuning unit T–110 until the limiter meter shows a peak reading.

(17) Shift the shunting unit connection to the grid (pin 6) of tube V–110.

(18) Tune the slug marked P of primary coil L–123 (fig. 6) in tuning unit T–110 until the limiter meter shows a peak reading. Adjust the input injection signal to the l-f reference limiter meter reading.

(19) With the test equipment connected as in (2), (3), and (14) above, and adjusted as in (4) above, repeat the shunting unit connections and tuning slug adjustments described in (5) through (8), (10) through (13), and (15) through (18) above, until no further peaking improvement is obtainable.

(20) Disconnect the shunting unit.

c. Receiver Oscillator, V–101. Frequency Meter Set SCR–211 (M–4), or its equivalent, may be used to adjust the tuning of the receiver oscillator. If the oscillator was proved to be off frequency by the trouble-shooting procedure followed in section II, proceed as follows:

(1) Loosely couple Frequency Meter Set SCR–211 to the oscillator. This may be done by placing a few turns of wire over the envelope of tube V–101 and connecting the other end of the coil to the frequency meter input terminal. Connect the headphones to the frequency meter.

(2) Adjust the frequency meter to measure 3.05 mc, and turn the TENTH MCS knob to detent position O.

(3) Using a screw driver, adjust the slub of tuning coils L–101 and L–102 in tuning unit T–101 (fig. 39) until a zero beat note is heard in the headphones connected to the frequency meter.

(4) Turn the TENTH MCS knob to detent position 9 and adjust the frequency meter to measure 3.95 mc.

(5) Adjust trimmer capacitor C–101A (fig. 6) until a zero beat note is heard in the frequency meter headphones.

(6) Repeat the adjustments of the inductance trimmer on T–101 for dial position O, and the trimmer capacitor C–101A for dial position 9, as described in the preceding steps, until a zero beat note is heard for both detent positions of the dial.

(7) Rotate the TENTH MCS knob through each one of positions 1 through 8, and for each step, adjust the frequency meter control until a zero beat note is heard. The frequency meter reading should increase from 3.05 mc ±5 kc in 100-kc steps as the knob is rotated from position 1 (3.15 mc) to position 8 (3.85 mc).

(8) If the above requirement is not met, proceed with the adjustments described in *d* below. If the requirement is met, proceed with the adjustments of the variable i-f amplifier, as described in *e* below.

d. Adjustment of Tenth MCS Dial Detent Screws. If the requirements of the preceding subparagraph are not met, that is, if the tracking error at any one or more of the dial detent positions exceeds the permissible 5-kc limit, it will be necessary to readjust the detent screws of the TENTH MCS control. The procedure is as follows:

(1) Remove the TENTH MCS and MCS knobs (fig. 12). To do this, remove the setscrews holding them to the dial shafts.

(2) Take out all screws around the periphery of the kidney-shaped dial plate, and remove the dial plate. This will expose the adjustable detent stops. Make sure to save all screws. They will be needed to replace parts. Replace the knobs to permit turning the dial.

(3) Set the TENTH MCS dial to the detent position at which the 5-kc tracking error limit was exceeded.

(4) Connect the frequency meter as described in *c* above, and set its frequency to the frequency corresponding to the particular detent position.

(5) Loosen the screw associated with the particular detent position.

(6) Using a pair of long-nosed pliers, turn the detent stop until a zero beat note is established in the headset.

(7) Holding the detent stop in position, retighten the detent stop screw.

(8) Repeat this procedure for each position at which the requirements of *c*(7) above are not met.

(9) Replace the dial plate cover and the knobs.

e. Variable i-f Amplifier.

(1) Connect the discriminator meter (terminals 5 and 1 of X–200).

(2) Connect the test signal generator (G–5) through a .006-μf capacitor between the grid (pin 6) of second variable i-f amplifier tube V–108 and chassis.

(3) Turn the TENTH MCS dial to position 9 and adjust the signal generator frequency to 5.45 mc with an output level to give the l-f reference reading when the discriminator meter reading is zero.

(4) Adjust trimmer capacitor C–101M (fig. 6) until the limiter meter shows a peak reading, keeping limiter meter constant at .6 volt.

(5) Set the TENTH MCS control to detent position O.

(6) Connect the shunting unit (.006 μf in series with 2,700 ohms) between the plate (pin 2) of V–108 and chassis.

(7) Adjust the frequency of the signal generator to 4.45 mc and adjust its output level so that the limiter meter reads .6 volt.

(8) Adjust the tuning slug of secondary coil L–120 (fig. 6) in tuning unit T–109 until a peak reading is obtained on the limiter meter, lowering the injected grid signal so that the limiter reading always is approximately .6 volt.

(9) Repeat (3) through (8) above until maximum limiter meter reading is obtained at both ends of the TENTH MCS dial without returning.

(10) Connect the shunting unit between the signal grid (pin 6) of V–109 and chassis.

(11) Reset the TENTH MCS dial to position 9, the signal generator frequency to 5.45 mc, and adjust the output level to obtain the l-f reference meter reading.

(12) Tune trimmer capacitor C–101K (fig. 6) until the limiter meter shows a peak reading, keeping limiter reading constant at .6 volt.

(13) Change the setting of the TENTH MCS dial to 0, the signal generator frequency to 4.45 mc, and adjust the output level to obtain the l-f reference meter reading.

(14) Adjust the slug of coil L–119 (fig. 6) in tuning unit T–109 until the limiter meter shows a peak reading, lowering the injected grid signal so that the limiter reading is always approximately .6 volt.

(15) Repeat (11) through (14) above.

(16) Disconnect the shunting unit.

(17) Shift the signal generator connection to the grid (pin 6) of V–107.

(18) Change the dial setting to 9, the signal generator frequency to 5.45 mc, and adjust the output level as before. Adjust trimmer capacitor C–101H (fig. 6) to obtain a peak reading on the limiter meter.

(19) Return the dial to 0 position, change the

signal frequency to 4.45 mc, and adjust the output level as before.

(20) Adjust tuning slug L–118 (fig. 6) in tuning unit T–108 to obtain a peak reading on the limiter meter, keeping meter reading at approximately .6 volt.

(21) Repeat (18) through (20) above.

(22) Reset the dial to position 9. Adjust the signal generator frequency to 5.45 mc, and adjust its output level to the h-f reference limiter meter reading (par. 57*d*(4)). Adjust trimmer capacitor C–101F (fig 6) until the limiter meter shows a peak reading.

(23) Return the dial to position 0, shift the signal generator connection to the signal grid (pin 6) of V–2, adjust its frequency to 4.45 mc, and adjust its output level to the h-f reference limiter meter reading. Adjust the slug of coil L–117 (fig. 6) in tuning unit T–107 to obtain a peak reading on the limiter meter.

(24) With the signal generator connected to pin 6 of V–2, repeat the tuning adjustment procedure outlined above, adjusting the coils for dial position 0 and signal generator frequency of 4.45 mc, and the trimmer capacitors for dial position 9 and signal generator frequency of 5.45 mc until no improvement in the peaking of the variable i-f amplifier circuits is obtainable.

(25) Check the gain and bandwidth of the i-f amplifier as described in paragraphs 57 and 79.

f. Crystal Oscillator-Harmonic Generator and First Harmonic Amplifier Circuits.

(1) Connect voltmeter M–1 negative lead to test point, E–4H, and the positive lead to chassis. Test point E–4H (fig. 5) is located at the junction of resistors R–16 and R–17 in the grid circuit of first harmonic amplifier V–4.

(2) Turn the MCS dial to the detent position which is the highest mc setting. Turn the TENTH MCS dial to detent position 0.

(3) Adjust trimmer capacitor C–16 (fig. 7) in the plate circuit of V–3 to obtain a peak reading on the meter.

(4) Shift the meter connection to test point E–2L (fig. 5), and adjust trimmer capacitor C–26 (fig. 4) for a peak reading of the meter.

(5) Turn the MCS dial to the detent position which is the lowest mc reading on the dial. Return the meter lead to test point E–4H.

(6) Adjust the tuning slug of coil L–6 (fig. 5) in tuning unit T–3 to obtain a peak reading on the meter.

(7) Transfer the meter connection from test point E–4H to test point E–2L. This test point is located at the junction of resistors R–7 and R–8, in the grid circuit of tube V–2.

(8) Adjust the tuning slug of L–8 (fig. 5) in tuning unit T–4 to obtain a peak reading on the meter.

(9) Repeat the adjustment of the coils and capacitor trimmers at the l-f and h-f ends of the MCS dial, respectively, as described above, until no further peaking adjustments of the inductance or capacitor trimmers is necessary.

(10) Check the voltmeter readings at test points E–4H and E–2L. The voltmeter should read more than .4 and 1 volt at E–4H and E–2L, respectively.

g. Receiver r-f Circuits.

(1) Connect the limiter meter (terminals 5 and 1 of X–200) and the discriminator meter (terminals 7 and 1 of X–200).

(2) Connect Signal Generator I–208, or equivalent, to the grid (pin 1) of receiver r-f amplifier tube V–1 through a .006-μf mica capacitor. Keep test leads as short as possible.

(3) Turn the MCS dial to the highest mc setting and turn the TENTH MCS dial to position 0.

(4) Adjust the signal generator frequency to correspond to the MCS dial setting, and adjust the output level to obtain the h-f reference limiter meter reading.

(5) Adjust trimmer capacitor C–1C (fig. 5) until the limiter meter shows a peak reading, and the discriminator meter M–1 shows a zero reading.

(6) Turn the MCS dial to the lowest mc setting.

(7) Adjust the signal generator frequency to correspond to the MCS dial setting, and adjust its output level to obtain a 1.8-volt reading on the limiter meter.

(8) Adjust the tuning slug of coil L–3 (fig. 4) in tuning unit T–2, until the limiter meter shows a peak reading, and the discriminator

meter shows a zero reading, keeping the limiter reading at approximately 1.8 volts.

(9) Repeat (3) through (8) above until no further peaking is obtainable when the discriminator meter reads zero.

(10) Shift the signal generator connection to the ANT jack on the front panel.

(11) Turn the MCS dial to the highest mc setting, turn the TENTH MCS dial to position 0, and adjust the frequency of the signal generator to correspond to the dial setting.

(12) Raise the output level of the signal generator until the limiter meter reading is slightly above that obtained with zero signal generator input.

(13) Readjust the frequency of the signal generator until the discriminator meter reads zero.

(14) Adjust the REC ANT TUNE screw (trimmer capacitor C–1A) to obtain a peak reading on the limiter meter. This adjustment screw is located on the front panel.

(15) Raise the output level of the signal generator to obtain a 1.8-volt reading on the limiter meter. Measure and note the signal generator output level necessary to obtain this reading.

(16) Turn the MCS dial to its lowest mc setting, and adjust the signal generator frequency to obtain a zero reading on the discriminator meter.

(17) Adjust the inductance of antenna coil L–1 (fig. 4) in tuning unit T–1 to obtain a peak reading on the limiter meter.

(18) With the test signal applied to the ANT connector, repeat the adjustments of coil L–3 (fig. 4), trimmer capacitor C–1C (fig. 5), coil L–1 (fig. 4), and antenna trimmer capacitor C–1A as described above, until no further peaking of the limiter meter is obtainable. Adjust the coils with the MCS dial set to the lowest mc setting, and adjust the capacitors with the MCS dial at its highest setting. The peak limiter meter reading should be obtained at the same time that the discriminator meter reads zero.

(19) Reduce the output level of the signal generator to zero and note the limiter meter readings. This reading should be between .2 volt and .6 volt.

72. Transmitter Alinement

a. Preparation. Make sure that the dummy antenna load is connected to the ANT jack. Connect a microphone (with push-to-talk button) to REC-TR CONTROL connector J–312, as shown in figure 43. Connect a pair of headphones to terminals E and D of J–312. Operate the DIAL LIGHT-OFF-ON-RING switch S–302 to the OFF position. Set the VOLUME control in the maximum clockwise position. Set the SQUELCH control to the OFF position. Turn the OPERATE switch on the power supply to the RECEIVE and TRANSMIT position, and turn the TRANS POWER switch to the HIGH position. Allow a warm-up period of a few minutes before proceeding with the alinement. All adjustment controls are accessible through the sides, top, and bottom of the panel and chassis assemblies (figs. 4 through 7).

Caution: High voltages are exposed when the transmitter is turned on. Exercise every precaution to avoid shock. Use insulated screw drivers. Before touching a screw driver or test probe to a terminal, make sure that adjustment is being made at the correct slug and that measurement is being made at the correct terminal. Refer to the schematic diagram for the unit (fig. 53, 54 or 55. *See inserts in back of manual.*)

b. Transmitter Oscillator V–104A. The aim of the following adjustments is to determine that transmitter oscillator V–104A tracks with receiver oscillator V–101 and with the i-f circuits of the receiver. The output of the oscillator is fed as sidetone to the i-f amplifier stages. If both the receiver oscillator and the transmitter oscillator are correctly tuned, the resultant beat frequency produced in the receiver second mixer provides a zero voltage at the output of the discriminator, as measured between terminals 7 and 1 of test socket X–200. If either of the oscillators is off frequency, the beat-frequency voltage at the output of the discriminator will not be zero, and its magnitude can be taken as a measure of tracking error. Since the receiver oscillator circuit and the i-f stages have already been alined in accordance with paragraph 71, it may be assumed that any tracking error shown is due to the transmitter oscillator. Make adjustments as follows:

(1) Connect meter M–1 between Terminals 7 and 1 of test socket X–200 (discriminator meter).

(2) Connect clip leads across capacitors

C–194B and C–194C to disable the afc circuit.

(3) Turn the TENTH MCS dial to detent position 9. Operate the push-to-talk switch.

(4) Adjust oscillator trimmer capacitor C–101D (fig. 6) to obtain a zero reading on the discriminator meter.

(5) Turn the TENTH MCS dial to detent position 0.

(6) Operate the microphone push-to-talk switch.

(7) Adjust the tuning slug (coils L–109 and L–110) on tuning unit T–103 (fig. 39) until a zero reading is obtained on the discriminator meter.

(8) Repeat steps (3) through (7) above until no further adjustment of T–103 and C–101D is necessary for zero readings on the discriminator meter.

(9) Turn the TENTH MCS dial in succession to each of the remaining detent positions (2 through 8) and observe the discriminator meter.

Requirement: For each detent position of the TENTH MCS dial, the discriminator meter should be less than .2 volt.

(10) If the above requirement is not met, a compromise adjustment of the trimmer capacitor, C–101D, and tuning inductance of T–103 is necessary. To do this, repeat the adjustment outlined above for detent positions 1 and 8 or 2 and 7 instead of for 0 and 9.

(11) After the requirement has been met for all detent positions of the TENTH MCS dial, remove the clip leads from across capacitors C–194B and C–194C, and recheck to determine that the discriminator meter still reads not more than .2 volt for each detent position of the dial.

c. Check of Crystal Oscillator-Harmonic Generator Operation. The crystal oscillator-harmonic generator operation has been checked and adjustments have been made in connection with the alinement of the receiver (par. 71*g*). Recheck as follows:

(1) Measure the voltage between terminal 3J and ground. This terminal is the stand-off insulator mounted on the side of the crystal-switch assembly (fig. 5). This voltage should be 12 volts for each detent position of the MCS dial. If the correct voltage is not obtained for any detent position, replace the crystal associated with that position. See label on crystal-switch assembly cover.

(2) Measure the grid drive for the first harmonic amplifier by measuring the voltage between test point E–4H (fig. 5) and chassis. If necessary, readjust C–16 (fig. 7) with the MCS dial in the highest frequency detent position, and L–6 (fig. 5) in T–3 with the dial in the lowest mc position, as described in paragraph 71*f*.

(3) Measure the output of the first harmonic amplifier by measuring the grid drive on the receiver first mixer between test point E–2L and chassis. Adjust, if necessary, as described in paragraph 71*f*.

(4) Measure the voltage between test points E–6A and E–6B (fig. 48). This voltage is a measure of the output of the second harmonic amplifier applied to the screen grid (pin 3) of transmitter mixer V–6.

Requirement: For a properly adjusted harmonic amplifier, the voltage between E–6A and E–6B (fig. 48) should be between 2 and 6 volts.

(5) If the above requirement is not met, turn the MCS dial to the lowest mc detent position, and adjust the tuning slug (coils L–9 and L–10) of tuning unit T–5 (fig. 5) until the meter between E–6A and E–6B (fig. 48) shows a peak reading. Turn the MCS control to the highest mc detent position, and adjust trimmer capacitor C–33 (fig. 7) until the meter shows a peak reading.

(6) Repeat the alternate adjustment of the tuning coil and the trimmer capacitor for the l-f and h-f ends of the dial, respectively, until no further peaking adjustment is possible.

Note. At this point, it may be necessary to recheck and, if necessary, readjust trimmer capacitors C–16, C–33 (fig. 7) and C–26 (fig. 4) (h-f end of dial) and tuning units T–3, T–4, and T–5 (fig. 5) (l-f end of dial) to obtain the best possible tuning adjustment of the crystal oscillator-harmonic generator and the harmonic amplifiers.

d. Preparation for Adjustment of Transmitter H-F Circuits.

(1) Turn the MCS dial to the detent position which is 1 mc below the highest mc setting of the dial. Turn the TENTH MCS dial to the zero detent position.

(2) Turn the OPERATE switch on the power supply to the TRANS and REC position, and the TRANS POWER switch on the power supply to the HIGH position.

Caution: High potentials of 450 volts are now applied to the transmitter. Be very careful not to touch any metal parts of the high-powered circuits with fingers. Use clips leads which are insulated against high voltages when making test connections.

(3) Connect a voltmeter (M–1) between test points E–9G and E–9F (fig. 47). The voltage measured at these test points is the power amplifier grid drive.

(4) Connect a voltmeter (M–1) between test points E–9H and E–9J (fig. 47). The voltage measured at this point gives an indication of the plate current of V–11.

Note. Test points E–9F through E–9J are grouped on the four-prong socket, J–3 (fig. 5). Test points E–9G and E–9F are labeled A on the socket. Test points E–9H and E–9J are labeled B on the socket.

(5) Operate the push-to-talk button and observe the grid voltage and plate current meter readings.

Requirement: The grid drive meter should read between 1.5 and 6 volts. At the same time, the plate current meter should read between .2 and .6 volt.

(6) If the meter readings are not within the specified limits, and if a check of tube socket voltages (par. 59) shows that all operating potentials to the transmitter are correct, proceed with the alinement adjustments described in the following paragraphs.

e. Transmitter H-F Circuit Tuning.

(1) Turn the TRANS POWER switch (power supply) to the LOW position.

(2) Turn the TRANS ANT COUPLING control on the front panel to the extreme counterclockwise position to obtain minimum coupling. To gain access to the control it is necessary to remove the waterproof cap.

(3) Using a short length of wire equipped with clips, connect test terminal 9M to ground. (This lead should be less than 2 inches long.)

(4) Connect the grid drive (E–9G and E–9F) and plate current (E–8H and E–9J) meters (fig. 48).

(5) Turn the OPERATE switch on the power supply to RECEIVE and TRANSMIT.

Caution: Test points E–9H and E–9J carry full plate voltage when power is turned on.

(6) Turn the MCS dial to the detent position which is 1 mc below the highest mc setting. Turn the TENTH MCS dial to detent position 0.

(7) Adjust trimmer capacitor C–1M (fig. 5) in the plate circuit of V–11 until a minimum (dip) reading is obtained on the plate current meter.

Requirement: The plate current meter should read 1.8 volts maximum when the dip reading is obtained.

(8) Set the MCS dial to the detent setting which is 1 mc above the lowest mc setting.

(9) Adjust the tuning slug of L–9 (fig. 5) in T–5 of the second harmonic amplifier, V–5, until a peak reading is obtained on the meter connected between test points E–6A and E–6B (fig. 47).

(10) Adjust the tuning slug of L–12 (fig. 7) in T–6 (plate circuit of transmitter mixer stage V–6) until the meter connected to test points E–7B and E–8G (fig. 47) shows a peak reading.

(11) Adjust the tuning slug of L–16 (fig. 7) in T–7 (plate circuit of r-f amplifier stage V–7 and V–8) until a peak reading is shown on the meter connected to test points E–7B and E–8G.

(12) Adjust the tuning slug of L–18 (fig. 7) in T–8 (plate circuit of transmitter drivers V–9 and V–10) until the meter connected to test points E–9F and E–9G (fig. 47) shows a peak reading.

(13) Using a screw driver, turn the fiber shaft on the top of the r-f coil assembly, which positions the shorted turn in antenna coupling assembly T–9 (fig. 49), until a minimum reading is obtained on the power amplifier plate current meter (E–9H and E–9J).

(14) Turn the MCS dial to the detent position which is one step below the highest mc setting.

(15) Adjust trimmer capacitor C–33 (fig. 7) (second harmonic amplifier V–5) to obtain a peak reading in the meter connected between test points E–6A and E–6B.

(16) Adjust trimmer capacitor C–1E (fig. 5) (transmitter mixer V–6) to obtain a peak reading on the meter connected between test points E–7B and E–8G.

(17) Adjust trimmer capacitor C–1G (fig. 5) (transmitter r-f amplifiers V–7 and V–8) to obtain a peak reading on the meter connected between test points E–7B and E–8G.

(18) Adjust trimmer capacitor C–1K (fig. 5) (transmitter drivers V–9 and V–10) to obtain a peak reading at the meter connected between test points E–9F and E–9G.

(19) Adjust trimmer capacitor C–1M (fig. 5) until a minimum reading is obtained on the power amplifier plate current meter (E–9H and E–9J).

(20) Repeat steps (6) through (19) above until no further peaking and dipping, as called for, is possible by adjustment of either coils or capacitor trimmers.

f. Neutralization Adjustment. The adjustment described below should not be attempted unless it is certain that neutralization is required, and then only by experienced maintenance personnel. Neutralization is adjusted at the factory, and the neutralization controls are sealed with glyptal. Unless major repairs have been made on the transmitter circuits, neutralization should not be required.

(1) Check whether neutralization is required, as follows:

(a) Check whether the driver stage (V–9 and V–10) is properly alined by noting whether peak readings of 3.5 volts minimum are obtained for both the h-f end of the dial and the l-f end of the dial.

(b) Disconnect the coaxial cable joining the transmitter mixer (V–6) and the transmit oscillator (V–104A), that is, disengage P–2 and J–102.

(c) Observe the meter connected between test points E–9F and E–9G.

Requirement: The voltage reading should drop to zero.

(2) If the above requirement is not met, neutralization adjustment is required. Proceed as follows:

(a) Remove the fuses in the 450-, 250- and 150-volt leads of the power supply.

(b) Break the glyptal seal on T–8 covering the shaft of neutralizing capacitor C–65 (fig. 7).

(c) Unsolder the green wire from the stand-off insulator identified as 7A which is located near coil slug adjustment L–16, part of T–7. This lead joins the —27-volt bias supply from J–309 to the transmitter circuits.

(d) Connect a voltmeter across test points E–7B and E–8G (fig. 47). Use the 3-volt scale of the meter.

(e) Connect a voltmeter (3-volt scale) between test points E–9G and E–9F (fig. 47).

(f) Set the power supply TRANS POWER switch in the HIGH position and set the OPERATE switch to TRANS and RECEIVER ON position.

(g) Turn the MCS dial to its highest mc setting. Turn the TENTH MCS dial to detent position 0.

(h) Operate the microphone push-to-talk switch.

(i) Adjust trimmer capacitor C–1G (fig. 5) in the plate circuit of the transmitter r-f stage until the meter connected to test points E–7B and E–8G shows a peak reading.

(j) Adjust trimmer capacitor C–1E (fig. 5) in the plate circuit of the transmitter mixer stage until the meter (E–7B and E–8G) shows a peak reading.

(k) Adjust trimmer capacitor C–33 (fig. 7) in the plate circuit of the second harmonic amplifier until the meter (E–7B and E–8G) shows a peak reading.

(l) Adjust trimmer capacitor C–1K (fig. 5) in the plate circuit of the transmitter driver stage until the meter connected to test points E–9G and E–9F shows a peak reading.

(m) Using a nonmetallic screw driver, adjust neutralizing capacitor C–65 (fig. 7) to obtain a minimum deflection (dip) on the meter connected to E–9G and E–9F. To make certain that a true minimum reading is obtained, rock trimmer capacitor C–65 (that is, vary the trimmer capacitor shaft back and forth gradually, reducing the excursions of the shaft beyond the points at which the meter reading starts to rise, finally setting at the exact point at which the lowest meter reading is obtained). Note the meter reading at the dip.

(n) Repeat steps (*i*) through (*m*) as many times as is necessary to reduce the meter reading at the dip to the lowest possible value.

Requirement: The meter reading at the dip should be less than .1 volt.

(o) Turn the power supply off and resolder the green lead to 7A. Reconnect the coaxial cable by engaging P–2 with J–102. Replace the fuses.

(p) Recheck the alinement of the transmitter h-f circuit in paragraph *e* above.

Section V. FINAL TESTING

73. General

If the unit does not meet the requirements of paragraph 52, repeat the trouble-shooting procedures given in paragraphs 52 through 60 to locate other faults. Make the necessary repairs. If the unit operates as required in paragraph 52, perform the tests outlined in the following paragraphs.

74. Over-All Receiver Sensitivity

Connect the test equipment as indicated in paragraph 50, with the following exceptions:

a. Connect an r-f signal generator (G–1), or equivalent, to the ANT connector on the front panel.

b. Connect an output meter (M–3) to the output terminals of the power audio amplifier stage, terminals A and B of J–312.

c. Set the controls on the front panel as follows:

Control	*Position*
SQUELCH	OFF.
DIAL LIGHT-OFF-ON-RING switch	OFF.
MCS dial	To lowest mc setting.
TENTH MCS dial.....	Zero.

d. Adjust the frequency of the signal generator to the frequency indicated by the setting of the MCS and TENTH MCS controls.

e. Adjust the signal generator output level to .5 microvolt.

f. Apply frequency modulation to the signal generator. The modulation should be 1,000 cycles at ±15-kc deviation.

g. Adjust the VOLUME control on the front panel until the output meter reads 600 mw.

h. Remove the modulation from the signal generator frequency, that is, apply an unmodulated carrier.

i. Note the reading of the output meter.

j. Change the setting of the MCS dial to the highest mc setting and retune the signal generator to the frequency corresponding to this dial setting.

k. Again apply frequency modulation in the form of the 1,000-cycle signal at ±15-kc deviation.

l. Adjust the VOLUME control until the output meter reads 600 mw.

m. Remove the modulation from the signal generator and again note the output meter reading.

n. Change the setting of the MCS dial to the mc position which is approximately at the center of the tuning range of the dial. Adjust the signal generator frequency accordingly. Repeat the above measurements for test signals with and without modulation.

Requirement: In each case the output meter reading for the unmodulated carrier signal should be 30 db below 600 mw. This means that the reading with an unmodulated carrier should be not more than about .6 mw. The reading thus obtained is the signal plus noise-to-noise ratio. This ratio should be at least 30 db.

75. Variable I-f Selectivity

The variable i-f amplifier selectivity should be measured in accordance with the following procedure:

a. Connect the signal generator through a .006–μf capacitor to the first mixer grid (pin 6) of V–2.

b. Connect the limiter meter to terminals 1 and 5 of test socket X–200.

c. Connect the discriminator meter to pins 7 and 1 of test socket X–200.

d. Turn the TENTH MCS dial to position 5.

e. Adjust a calibrated signal generator to a frequency of 4.95 mc (unmodulated) and adjust the level to produce a .6-volt reading on the limiter meter.

f. The discriminator meter should read .16 volt.

g. Measure the signal generator output level required to obtain the limiter meter reading stated above.

h. Double the output of the signal generator.

i. Raise the frequency of the signal generator to a frequency above 4.95 mc until the .5-volt limiter meter reading is again obtained.

j. Tune the signal generator to a frequency below 4.95 mc until the same limiter meter reading is again obtained. Note the frequency above and below 4.95 mc necessary to obtain the required limiter meter reading.

Requirement: The .6-volt limiter meter reading should be obtained for equal increments of the test frequency above and below 4.95 mc. The difference between the frequency above and below 4.95 mc should be 85 ± 10 kc. The first requirement determines whether or not the selectivity curve of the i-f amplifiers is symmetrical as required. The second requirement determines the bandwidth of the i-f amplifier at the points 6db (twice) below the center frequency.

k. Reset the signal generator frequency to 4.95 mc and again set the limiter meter reading to .6 volt.

l. Raise the level of the signal generator to a value which is ten times the output level obtained in the preceding step.

m. Raise the signal generator frequency gradually above 4.95 mc until a point is reached at which the same limiter meter reading again is obtained. Note the frequency.

n. Lower the frequency of the signal generator to a point below 4.95 mc until the same limiter meter reading is obtained again.

Requirements: The difference between the higher frequency and 4.95 mc should be equal to the difference between the frequency below 4.95 mc and 4.95 mc. For signal input levels ten times that required to obtain .6 volt at the second limiter grid, the difference between the higher and the lower frequencies should be 110 ±15 kc.

o. If the above requirements are not met, it is necessary to realine the i-f amplifier. The alinement procedure is given in paragraph 71*c*.

76. Spurious Response

The purpose of the following check is to determine that the spurious response, including those of the image and of the i.f., is sufficiently below the response to signals so that the limiter grid current for high levels of signal input does not exceed the limiter grid current obtained with the signal of normal input level.

a. Apply a test signal to the ANT connector on the front panel at the frequencies listed below for the particular receiver-transmitter under test.

(1) Receiver - Transmitter RT–66/GRC—23.5 mc.

(2) Receiver - Transmitter RT–67/GRC—33.5 mc.

(3) Receiver - Transmitter RT–68/GRC—46.5 mc.

b. Connect the limiter meter to terminals 5 and 1 of test socket X–200.

c. Adjust the signal generator output level to .5 microvolt.

d. Observe the limiter meter reading.

e. Increase the signal input level by 50 db, which is approximately 160 microvolts.

f. Vary the oscillator frequency between 2 mc and 100 mc. Observe the meter reading.

Requirements: The limiter meter reading should remain less than that obtained with the .5-microvolt signal.

77. Calibration

A heterodyne type Frequency Meter TS–174/U (M–5) is required for this test.

a. Couple the frequency meter to the dummy load connected to the ANT connector on the front panel.

b. Set the MCS dial to its lowest mc setting, leaving the TENTH MCS dial set at zero.

c. Turn on the transmitter by operating the microphone push-to-talk button and by setting the DIAL LIGHT-OFF-ON-RING switch to the RING position.

d. Adjust the comparison frequency provided by the frequency meter until a beat note is obtained. Note the frequency at which the beat note is obtained.

e. Measure and record the frequency output of the transmitter for each of the remaining mc settings of the MCS dial.

Requirement: For each mc setting of the dial, the frequency should not be more than ±7.5 kc from the reading on the MCS dial.

78. Limiting Action

a. Connect the test signal generator to the ANT connector on the front panel and adjust its frequency as follows:

(1) Receiver - Transmitter RT–66/GRC—23.5 mc.

(2) Receiver - Transmitter RT–67/GRC—33.5 mc.

(3) Receiver - Transmitter RT–68/GRC—46.5 mc.

b. Set the MCS and TENTH MCS dial to the

positions corresponding to the frequencies indicated above.

c. Connect an a-f output meter to terminals E and D of J–312.

d. Apply 1,000-cycle modulation at ±15 kc deviation to the test signal.

e. Adjust the signal generator output level to .75 microvolt and observe the reading of the output meter. Raise the signal generator output level in the following steps: 10, 1,000, 100,000 microvolts. Observe the output meter reading.

Requirement: The output meter reading should remain substantially the same as that for the .75-microvolt signal.

79. Check of Bandwidth

a. Fixed I-F Amplifier.

(1) Connect a meter (M–1) between terminals 7 and 1 of X–200, and a meter (M–1) to terminals 5 and 1 of X–200.

(2) Connect the signal generator (G–5) in series with a .006–μf capacitor between terminal 6 of V–109 and chassis.

(3) Adjust the signal generator frequency to 1.4 mc, and adjust the output level to obtain the l-f reference limiter meter reading. Note the output level.

(4) Double the output of the signal generator (that is, raise its output level by 6 db).

(5) Tune the signal generator to the frequency above 1.4 mc for which the l-f reference limiter meter reading is obtained again.

(6) Tune the signal generator to the frequency below 1.4 mc for which the l-f reference limiter meter reading is obtained again.

(7) Compute the difference between the signal generator frequency settings obtained in steps (5) and (6) above. This is the bandwidth of the fixed i-f amplifier at the points 6 db below center frequency.

Requirements: The bandwidth at the 6-db points should be approximately 95 kc. The amount by which the signal frequency is reduced below 1.4 mc to obtain the l-f reference limiter meter reading should be approximately equal to the amount by which it was increased above 1.4 mc to obtain the same result.

b. Variable I-F Amplifier.

(1) Connect the 0–50 microammeter between terminals 4 and 8 of X–200.

(2) Connect the signal generator between terminal 6 of V–2 and chassis.

(3) Turn the TENTH MCS dial to detent position 0.

(4) Adjust the output of the signal generator to 4.45 mc, and adjust its level to give the h-f reference limiter meter reading on the meter. Note the level of the signal generator output.

(5) Raise the output level of the signal generator by 6 db (double the level).

(6) Raise the frequency of the signal generator above 4.45 mc until the reading of step (4) above again is obtained. Note the signal generator frequency for which this occurs.

(7) Lower the frequency of the signal generator below 4.45 mc and note the frequency at which the reading of step (4) above again is obtained.

(8) Compute the difference between the two frequencies of steps (6) and (7) above. This is the bandwidth at points 6 db below reference.

(9) Compute the difference between each of the frequencies of (6) and (7) above and 4.45 mc.

Requirements: The bandwidth of the i-f amplifier should be approximately 110 kc. The 6-db point above 4.45 should be about the same number of kc away from the center frequency as the 6-db point below 4.45 mc.

c. Over-All Receiver.

(1) Set the MCS dial to a detent setting which is near the approximate center of its frequency range. For example, in the case of Receiver-Transmitter RT–66/GRC, this would be position 33. Set the TENTH MCS dial to 0.

(2) Connect the r-f signal generator to the ANT connector on the front panel, and adjust its frequency corresponding to the setting of the MCS dial.

(3) Connect the meters to terminals 7 and 1 of X–200 and to terminals 5 and 1 of X–200 (discriminator and limiter meters, respectively).

(4) Adjust the frequency of the generator until the discriminator meter (terminals 7 and 1 of X–200) reads zero.

(5) Adjust the output level of the signal generator to 0, and observe the reading of the limiter meter (terminals 5 and 1 of X–200).

(6) Adjust the output level of the signal generator until the limiter meter reads a value which is about 10 percent above that obtained in step (5) above. Note the output level of the signal generator required to obtain that reading.

(7) Raise the output level of the signal generator by 6 db (that is, double its output). Note the limiter meter reading.

(8) Tune the signal generator to a frequency above the center frequency until the limiter meter reading obtained in step (7) above again is obtained. Note the frequency for which this occurs.

(9) Tune the signal generator to a frequency below the center frequency until the limiter meter again reads as in step (7) above. Note the frequency.

(10) Compute the difference between the frequencies obtained in steps (8) and (9) above. This is the over-all receiver bandwidth at the 6-db points.

(11) Compute the difference between each of the frequencies at the 6-db points and the center frequency. This figure is a measure of the symmetry of the selectivity curve.

Requirements: The bandwidth of the receiver at the points 6 db below center frequency should be about 85 kc. The difference between the frequencies above and below the center frequency should be not greater than 20 kc.

d. Analysis. Incorrect bandwidth is indicative of improper alinement in the stages involved. An unsymmetrical selectivity curve is indicative of a defective component in the tuned circuit or of improper coupling between primary and secondary windings of double-tuned stages. Accordingly, if the measurements made in the preceding paragraphs show that either of these defects may exist, recheck the alinement of the receiver stages, as described in paragraph 71, and if alinement fails to clear the trouble, look for defective damping resistors, bypass capacitors, or tuning coils.

CHAPTER 4

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

80. Repacking for Shipment or Limited Storage

Wrap and pack equipment securely according to directions given in Packaging Specifications JAN–P–100 or as directed by the Officer-in-Charge.

81. Demolition of Matériel to Prevent Enemy Use

The demolition procedures outlined below will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander. DESTROY EVERYTHING.

a. Smash. Smash capacitors, transformers, resistors, sockets, plugs, and other components, using sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. Cut. Cut wiring, using axes, handaxes, or machetes.

c. Burn. Burn technical manual, records and forms, resistors, capacitors, and transformers, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend chassis, panels, and covers.

e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310-20-3 and SR 310-20-4. Check Department of the Army Supply Catalog SIG 1 for signal supply catalogs.

1. Army Regulations

AR 380–5 Safeguarding Military Information.

2. Supply Publications

SIG 1 Introduction and Index.
SB 11–47 Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11–76 Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Publication on Test Equipment

TM 11–2627 Tube Tester I–177.

4. Painting and Preserving

TB SIG 13 Moistureproofing and Fungiproofing Signal Corps Equipment.
TM 9–2851 Painting Instructions for Field Use.

5. Demolition

FM 5–25 Explosives and Demolitions.

6. Other Publications

FM 24–18 Field Radio Techniques.
SR 310–20–3 Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).
SR 310–20–4 Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, Tables of Equipment.
SR 700–45–5 Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5 Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66(Army)).
TB SIG 66 Winter Maintenance of Signal Equipment.
TB SIG 72 Tropical Maintenance of Ground Signal Equipment.
TB SIG 75 Desert Maintenance of Ground Signal Equipment.
TB SIG 123 Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178 Preventive Maintenance Guide for Radio Communication Equipment.
TM 1–455 Electrical Fundamentals.
TM 9–2857 Storage Batteries Lead-Acid Type.
TM 11–310 Schematic Diagrams for Maintenance of Ground Radio Communication Sets.
TM 11–430 Batteries for Signal Communication. Except those pertaining to Aircraft.
TM 11–453 Shop Work.
TM 11–455 Radio Fundamentals.
TM 11–483 Suppression of Radio Noises.
TM 11–486 Electrical Communication Systems Engineering.
TM 11–660 Introduction to Electronics.
TM 11–4000 Trouble Shooting and Repair of Radio Equipment.
TM 38–650 Basic Maintenance Manual.

7. Abbreviations

ac.....alternating current.
af.....audio frequency.
afc.....automatic frequency control.
amp.....ampere(s).
C.....centigrade.
db.....decibel(s).
dc.....direct current.
F.....Fahrenheit.
f-m.....frequency-modulation.
hf.....high frequency.
hv.....high voltage.
i.f.....intermediate frequency.
kc.....kilocycle.
lv.....low voltage.
ma.....milliampere.
mc.....megacycle.
mw.....milliwatt.
rf.....radio frequency.
rms.....root mean square.
μa.....microampere.
μf, $\mu\mu$f.....microfarad, micromicrofarad.
μv.....microvolt.

8. Glossary

For explanation of terms used in this manual, refer to TM 11–455.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite a T/O & E, TA, T/BA, SIG 6, SIG 7 & 8, SIG 7–8–10, SIG 10, list of allowances of expendable material, or other authorized supply basis. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog see the latest issue of SIG 1, Introduction and Index.

2. Identification Table of Parts for Receiver-Transmitters RT–66 GRC, RT–67/GRC, and RT–68/GRC

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
				ARMY-NAVY RECEIVER-TRANSMITTER RT–66/GRC: vehicular, gnd; FM; xmtr output approx 22 w max; freq range of both rec and xmtr 20–27.9 mc in 1 band; nom input 5.6, 6.3, −27, 85, 105, 150, 250, and 450 v DC; mtd in rigidized metal case, 11¼″ wd x 9¼″ h x 12⅞″ d o/a; w/2 mtg rails on bottom; immersion and fungus resistant; self-luminous dial and control knob markings; p/o Army-Navy Radio Sets AN/GRC–3, AN/GRC–4, AN/VRQ–1, and AN/VRC–8; Fed Tele & Rad part/dwg #GA–2514–14–GRI; U. S. Army spec #71–3320.	2C5130–66
				ARMY-NAVY RECEIVER-TRANSMITTER RT–67/GRC: vehicular, gnd; FM; xmtr output approx 12 w max; freq range of both rec and xmtr 27–38.9 mc in 1 band; nom input 5.6, 6.3, −27, 85, 105, 250, and 450 v DC; mtd in rigidized metal case, 11¼″ wd x 9¼″ h x 12⅞″ d o/a; w/2 mtg rails on bottom; immersion and fungus resistant; self-luminous dial and control knob markings; p/o Army-Navy Radio Sets AN/GRC–5, AN/GRC–6, AN/VRQ–2, and AN/VRC–9; Fed Tele & Rad part/dwg #GA–2514–14–GR II; U. S. Army spec #71–3320.	2C5130–67
				ARMY-NAVY RECEIVER-TRANSMITTER RT–68/GRC: vehicular, gnd; FM; xmtr output approx 22 w max; freq range of both rec and xmtr 38–54.9 mc in 1 band; nom input 5.6, 6.3, −27, 85, 105, 150, 250, and 450 v DC; mtd in rigidized metal case, 11¼″ wd x 9¼″ h x 12⅞″ d o/a; w/2 mtg rails on bottom; immersion and fungus resistant; self-luminous dial and control knob markings; p/o Army-Navy Radio Sets AN/GRC–7, AN/GRC–8, AN/VRQ–3, and AN/VRC–10; Fed Tele & Rad part/dwg #GA–2514–14GR III; U. S. Army spec #71–3320.	2C5130–68
O–323, O–324, O–325, O–326	O–323, O–324, O–325, O–326	O–323, O–324, O–325, O–326	Knob stop adjustable arms.	ARM: SS, passivated, olive drab enamel arm w/ end block red enamel; 1 side green other side round w/offset arm; approx 2⅜″ lg x 1.562″ wd x .125″ thk; hole in ctr of round portion .63″ diam; mts on hub by means of ctr hole; Fed Tele & Rad part/dwg #GB–3075–12.	2Z380–98
E–117	E–117	E–117	Capacitor and resistor mounting board.	BOARD, terminal: 20 solder type term; term 1.187″ apart, ¼″ c to c; 1am phenolic board; 3⅛″ lg x 2⅜″ wd x 1⅜″ thk o/a; two #6–32 thd mtg holes on 2⅞″ mtg/c; mtg bkt attached, 1 on either end; fuse clip mtd on rear end of board; p/o Fed Tele & Rad #GA–2290–14 i-f chassis assem; Fed Tele & Rad part/dwg #GA–2031–2.	3Z770–20.31

E–118	E–118	E–118	Capacitor and resistor mounting board.	BOARD, terminal: 24 solder type term; term 1.187″ apart, ¼″ c to c; lam phenolic board; 3⅝″ lg x 2³⁄₁₆″ wd x ⅞″ thk o/a; two #6–32 thd mtg holes on 3¼″ mtg/c; mtg bkt attached, 1 on either end; p/o Fed Tele & Rad #GA–2290–14 i-f chassis assem; Fed Tele & Rad part/dwg #GA–2029–2.	3Z770–24.20
E–119	E–119	E–119	Capacitor and resistor mounting board.	BOARD, terminal: 28 term, 26 uss standoff type solder studs and 2 gnd solder lugs; steel board w/formed mtg bkt 4³⁄₈″ lg x 2⅛″ wd x 1″ thk o/a; three .187″ diam mtg holes, 2 on bottom on 3.937″ mtg/c, 1 on side ⅜″ from top edge; metal parts electro tin pl; p/o Fed Tele & Rad #GA–2290–14 i-f chassis assem; Fed Tele & Rad part/dwg #GA–2035–2.	3Z770–28.15
O–2			Antenna tuning capacitor C–74 adjustment.	CAM: var; c to c 1 Fed Tele & Rad #GC–1511–12 rotor, 6 GB 1432–2 links, 1 ea #GB–1439–2–1 and #GB–1440–2–1 links, 9 ea #GB–1501–2 studs and #GC–15032–2 holders, 9 adj screw and miscellaneous washers, groove pins, retainer rings, and set screws; round shape; approx 2.156″ diam x 1.093″ lg o/a; .251″ diam mtg hole; mts on ¼″ diam shaft by means of two #3–32 set screws; 8 sect link type hinged cam track adj by means of adj screws; Fed Tele & Rad part/dwg #GA–1518–14, Group 1.	2Z1600–100
	O–2		Antenna tuning capacitor C–74 adjustment.	CAM: var; c to c 1 Fed Tele & Rad #GC–1512–12 rotor, 10 GB 1437–2 links, 1 ea #GB–1439–2–2 and #GB–1440–2–2 links, 13 ea #GB–1501–2 studs and #GC–1503–2 holders; 13 adj screws and miscellaneous washers, groove pins, retainer rings, and set screws; round shape; approx 2.156″ diam x 1.093″ lg o/a; .251″ diam mtg hole; mts on ¼″ diam shaft by means of two #3–32 set screws; 12 set link type hinged cam track adj by means of adj screws; Fed Tele & Rad part/dwg #GA–1518–14, Group 2.	2Z1600–99
		O–2	Antenna tuning capacitor C–74 adjustment.	CAM: var; c to c 1 Fed Tele & Rad #GC–1513–2 rotor, 15 #GB–1438–2 links, 1 ea #GB–1439–2–3 and #GB–1440–2–3 links, 18 ea #GB–1501–2 studs and #GC–1503–2 holders, 18 adj screws and miscellaneous washers, groove pins, retainer rings, and set screws; round shape; approx 2.156″ diam x 1.093″ lg o/a; .251″ diam mtg hole; mts on ¼″ shaft by means of two #8–32 set screws; 17 sect link type hinged cam track adj by means of adj screw; Fed Tele & Rad part/dwg #GA–1518–14, Group 3.	2Z1600–101
		C–37	V–5 neutralizing.	CAPACITOR, fixed: ceramic dielectric; .75 $\mu\mu$f ±.25 $\mu\mu$f; 500 vdcw; JAN type CC21CKR75C.	3D9000–75–3
C–8,	C–8, C–18,	C–8, C–18,	V–1 plate circuit tuning. V–3 plate circuit tuning, part of T–3.	CAPACITOR, fixed: ceramic dielectric; 5 $\mu\mu$f ±.5 $\mu\mu$f; 500 vdcw; JAN type CC21LH050D.	3D9005–117
C–54, C–77, C–204	C–54,	C–54,	V–7 plate circuit padder. V–6 plate tuning. V–103 coupling.		
C–302	C–302	C–302	D-c blocking to meter circuit.		

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT-66/GRC	RT-67/GRC	RT-68/GRC			
C-12,	C-12,	C-12,	Feedback capacitor for xtal oscillator V-3.	CAPACITOR, fixed: ceramic dielectric; 10 μμf ±.5 μμf; 500 vdcw; JAN type CC21PH100D.	3D9010-165
		C-35,	V-5 plate circuit tuning, part of T-5.		
C-39,	C-39,	C-39,	Voltage divider for V-6.		
C-122	C-122	C-122	Coupling capacitor for transmitter V-104A.		
C-35			V-5 plate circuit tuning, part of T-5.	CAPACITOR, fixed: ceramic dielectric; 12 μμf ±10%; 500 vdcw; JAN type CC21LH120K.	3D9012-75
C-20,	C-20,	C-20,	Coupling capacitor for first harmonic amplifier V-4 to first receiver mixer V-2.	CAPACITOR, fixed: ceramic dielectric; 15 μμf, ±10%; 500 vdcw; JAN type CC21CJ150K.	3D9015-128
C-124	C-124	C-124	V-104A transmitter oscillator tuning, part of T-103.		
C-151	C-151	C-151	V-107 plate circuit tuning, part of T-108.	CAPACITOR, fixed: ceramic dielectric; 15 μμf ±10%; 500 vdcw; JAN type CC21TJ150K.	3D9015-129
C-2	C-2	C-2	V-1 antenna tuning.	CAPACITOR, fixed: ceramic dielectric; 18 μμf ±10%; 500 vdcw; JAN type CC26LH180K.	3D9018-27
C-102	C-102	C-102	V-101 receiver oscillator tuning, part of T-101.	CAPACITOR, fixed: ceramic dielectric; 20 μμf ±10%; 500 vdcw; JAN type CC20TH200K.	3D9020-60
	C-35		Tuning for second harmonic amplifier V-5, part of T-5.	CAPACITOR, fixed: ceramic dielectric; 20 μμf ±10%; 500 vdcw; JAN type CC21LH200K.	3D9020-61
C-126	C-126	C-126	V-104A voltage divider, part of T-103.	CAPACITOR, fixed: ceramic dielectric; 24 μμf ±10%; 500 vdcw; JAN type CC21TH240K.	3D9024-46
C-7,	C-7,	C-7,	V-1 plate circuit tuning.	CAPACITOR, fixed: ceramic dielectric; 24 μμf ±10%; 500 vdcw; JAN type CC21UJ240K.	3D9024-44
C-137,	C-137,	C-137,	V-105 pre-emphasis.		
C-138	C-138	C-138	V-106 pre-emphasis.		
C-187,	C-187,	C-187,	V-113 and V-114 discriminator tuning, part of T-113.	CAPACITOR, fixed: ceramic dielectric; 30 μμf ±10%; 500 vdcw; JAN type CC20SH300K.	3D9030-61
C-188,	C-188,	C-188	V-113 discriminator tuning, part of T-113.		
C-189	C-189	C-189	V-114 discriminator tuning, part of T-113.		
C-167,	C-167,	C-167,	V-109 plate circuit tuning, part of T-110.	CAPACITOR, fixed: ceramic dielectric; 30 μμf ±10%; 500 vdcw; JAN type CC21TH300K.	3D9030-46

C–168,	C–168,	C–168,	V–110 grid circuit tuning, part of T–110.		
C–172,	C–172,	C–172,	V–110 plate circuit tuning, part of T–111.		
C–175,	C–175,	C–175,	V–111 grid circuit tuning, part of T–111.		
C–181,	C–181,	C–181,	V–111 plate circuit tuning, part of T–112.		
C–182	C–182	C–182	V–112 grid circuit tuning, part of T–112.		
C–156,	C–156,	C–156,	V–108 plate circuit tuning.	CAPACITOR, fixed: ceramic dielectric; 30 $\mu\mu$f ±10%; 500 vdcw; JAN type CC25LH300K.	3D9030–62
C–160	C–160	C–160			
C–169,	C–169,	C–169,	V–110 grid coupling, part of T–110.	CAPACITOR, fixed: ceramic dielectric; 47 $\mu\mu$f ±10%; 500 vdcw; JAN type CC30RH470K.	3D9047–53
C–176,	C–176,	C–176,	V–110 grid coupling, part of T–111.		
C–183	C–183	C–183	V–112 grid coupling, part of T–112.		
C–3,	C–3,	C–3,	V–1 grid coupling.	CAPACITOR, fixed: ceramic dielectric; 51 $\mu\mu$f ±10%; 500 vdcw; JAN type CC21UK510K.	3D9051–8
C–13,	C–13,	C–13,	V–3 filament voltage divider.		
C–25,	C–25,		V–4 padder.		
C–29,	C–29,	C–29,	V–5 input coupling.		
C–47,	C–47,	C–47,	V–7 input coupling, part of T–107.		
C–57,	C–57,	C–57,	V–9 input coupling.		
C–67,	C–67,	C–67,	V–11 input coupling.		
C–105,	C–105,	C–105,	V–101 padder.		
C–106,	C–106,	C–106,	Coupling from receiver oscillator V–101 to second receiver mixer V–109.		
C–129,	C–129,	C–129,	V–104A grid tuning.		
C–147,	C–147,	C–147,	V–107 input coupling.		
C–153,	C–153,	C–153,	V–108 input coupling, part of T–108.		
C–161	C–161	C–161	V–109 input coupling.		
C–125	C–125	C–125	V–104A voltage divider, part of T–103.	CAPACITOR, fixed: ceramic dielectric; 51 $\mu\mu$f ±10%; 500 vdcw; JAN type CC30RH510K.	3D9051–59
C–21,	C–21,	C–21,	V–4 input coupling.	CAPACITOR, fixed: ceramic dielectric; 100 $\mu\mu$f ±5%; 500 vdcw; JAN type CC26UK101J.	3D9100–228
C–38,	C–38,	C–38,	V–6 input coupling from V–5.		
C–48,	C–48,	C–48,	V–8 input coupling.		
C–196	C–196	C–196	V–113 and V–114 meter filter.		

Ref symbol RT–66/GRC	Ref symbol RT–67/GRC	Ref symbol RT–68/GRC	Function of part	Name of part and description	Signal Corps stock No.
C–148,	C–148,	C–148,	V–2 plate circuit tuning, part of T–107.	CAPACITOR, fixed: ceramic dielectric; 240 $\mu\mu$f $\pm 5\%$; 500 vdcw; JAN type CC35TH241J.	3D9240–26
C–152	C–152	C–152	V–107 plate circuit tuning, part of T–108.		
C–157,	C–157,	C–157,	V–108 plate circuit tuning part of T–109.	CAPACITOR, fixed: ceramic dielectric; 240 $\mu\mu$f $\pm 5\%$; 500 vdcw; JAN type CC36TH241J.	3D9240–27
C–159	C–159	C–159	V–109 plate circuit tuning.		
C–123	C–123	C–123	V–104A padder.	CAPACITOR, fixed: ceramic dielectric; 330 $\mu\mu$f $\pm 10\%$; 500 vdcw; JAN type CC45TH331K.	3D9330–23
C–5,	C–5,	C–5,	V–1 screen bypass.	CAPACITOR, fixed: ceramic dielectric; 500 $\mu\mu$f $\pm 20\%$; var temp coef; 500 vdcw; .46″ lg x .24″ diam; radial wire leads; dipped phenolic insulation; Erie type #337 Hi–K Ceramicon; Fed Tele & Rad part/dwg #GH–2094–2–2.	3D9500–237
C–6,	C–6,	C–6,	V–1 padder.		
C–9,	C–9,	C–9,	Coupling to V–2.		
C–15,	C–15,	C–15,	V–3 d–c blocking.		
C–22,	C–22,	C–22,	V–4 meter bypass.		
		C–25,	V–4 d–c blocking.		
C–30,	C–30,	C–30,	V–5 filament bypass.		
C–31,	C–31,	C–31,	V–5 filament bypass.		
C–32,	C–32,	C–32,	V–5 d–c blocking.		
C–43,	C–43,	C–43,	V–5 meter bypass.		
C–63,	C–63,	C–63,	V–10 meter bypass.		
C–64,	C–64,	C–64,	V–9 meter bypass.		
C–136,	C–136	C–136,	V–105 meter bypass.		
C–139,	C–139,	C–139,	V–104B meter bypass.		
C–162,	C–162,	C–162,	V–109 meter filter.		
C–170,	C–170,	C–170,	V–110 meter filter, part of T–110.		
C–177,	C–177,	C–177,	V–111 meter filter, part of T–111.		
C–184	C–184	C–184	V–112 meter filter, part of T–112.		
		C–27,	V–4 padder.	CAPACITOR, fixed; ceramic dielectric; 1000 $\mu\mu$f $\pm 10\%$; var temp coef; 500 vdcw; .71″ lg x .24″ diam; radial wire leads; dipped phenolic insulation; Erie type #337 Hi–K Ceramicon; Fed Tele & Rad part/dwg #GH–2094–2–7.	3DA1–291
		C–34	V–5 padder.		
C–11,	C–11,	C–11,	V–3 plate bypass.	CAPACITOR, fixed: ceramic dielectric; 1500 $\mu\mu$f $\pm 20\%$; var temp coef; 500 vdcw; .71″ lg x .24″ diam; radial wire leads; dipped phenolic insulation; Erie Type #337 Hi–K Ceramicon; Fed Tele & Rad part/dwg #GH–2094–2–3.	3DA1.500–50
C–14,	C–14,	C–14,	V–3 filament bypass.		
C–23,	C–23,	C–23,	V–4 suppressor bypass.		
C–24,	C–24,	C–24,	V–4 screen bypass.		
C–40,	C–40,	C–40,	V–6 decoupling, bypass.		

C–41,	C–41,	C–41,	V–6 filament bypass.		
C–42,	C–42,	C–42,	V–6 filament bypass.		
C–44,	C–44,	C–44,	V–6 screen bypass.		
C–46,	C–46,	C–46,	V–7 and V–8 filament bypass.		
C–49,	C–49,	C–49,	V–7 filament bypass.		
C–50,	C–50,	C–50,	V–8 filament bypass.		
C–51,	C–51,	C–51,	V–7 filament bypass.		
C–52,	C–52,	C–52,	V–8 filament bypass.		
C–53,	C–53,	C–53,	V–7 and V–8 screen bypass.		
C–55,	C–55,	C–55,	V–7 and V–8 B+ bypass.		
C–58,	C–58,	C–58,	V–9 and V–10 decoupling, bypass.		
C–59,	C–59,	C–59,	V–9 and V–10 decoupling, bypass.		
C–60,	C–60,	C–60,	V–9 filament bypass.		
C–61,	C–61,	C–61,	V–10 filament bypass.		
C–62,	C–62,	C–62,	V–9 and V–10 screen bypass.		
C–68,	C–68,	C–68,	V–9 decoupling, bypass.		
C–70,	C–70,	C–70,	V–11 decoupling, bypass.		
C–71,	C–71,	C–71,	V–11 filament bypass.		
C–130,	C–130,	C–130,	V–104A d-c blocking, part of T–104.		
C–140,	C–140,	C–140,	V–104B coupling.		
C–164,	C–164,	C–164,	V–109 meter bypass.		
C–198,	C–198,	C–198,	V–115 input coupling.		
C–301,	C–301,	C–301,	J–309–N filament bypass.		
C–304	C–304	C–304	S–301–METER meter bypass.		
	C–4,	C–4,	V–1 decoupling, bypass.	CAPACITOR, fixed: ceramic dielectric; 3000 $\mu\mu$f ±20%; var temp coef; 500 vdcw; .937″ lg x .312″ diam; radial wire leads; dipped phenolic insulation; Erie type #337 Hi–K Ceramicon; Fed Tele & Rad part/dwg #GH–2094–5.	3DA3–137
C–10,	C–10,	C–10,	V–2 screen bypass.		
C–45,	C–45,	C–45,	V–6 plate circuit decoupling.		
C–56,	C–56,	C–56,	V–7 plate circuit decoupling.		
C–66,	C–66,	C–66,	V–9 plate circuit decoupling.		
	C–69,	C–69,	Grid bypass filter for V–11.		
C–76,	C–76,	C–76,	V–1 grid bypass.		
C–112,	C–112,	C–112,	V–102 meter bypass.		
C–116,	C–116,	C–116,	V–103 filament bypass.		
C–131,	C–131,	C–131,	V–105 and V–106 grid leak capacitor, part of T–104.		
C–132,	C–132,	C–132,	Screen grid bypass and filter for V–106.		
C–133,	C–133,	C–133,	Screen grid bypass and filter for V–107.		
C–134,	C–134,	C–134,	V–105 filament bypass.		
C–135,	C–135,	C–135,	V–106 filament bypass.		
C–146,	C–146,	C–146,	V–2 decoupling, bypass.		
C–150,	C–150,	C–150,	V–107 screen bypass.		

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
C–155,	C–155,	C–155,	V–108 screen bypass.		
C–158,	C–158,	C–158,	V–108 plate circuit bypass, part of T–109.		
C–166,	C–166,	C–166,	V–109 screen bypass.		
C–171,	C–171,	C–171,	V–110 meter bypass.		
C–173,	C–173,	C–173,	V–110 screen bypass.		
C–180,	C–180,	C–180,	V–111 screen bypass.		
C–186,	C–186,	C–186,	V–112 screen bypass.		
C–190,	C–190,	C–190,	V–113 meter bypass.		
C–195,	C–195,	C–195,	V–113 and V–114 filament bypass.		
C–305	C–305	C–305	M–301 meter bypass.		
C–19,	C–19,	C–19,	V–3 tuning, part of T–3.	CAPACITOR, fixed: ceramic dielectric; 3000 $\mu\mu$f ±20%; var temp coef; 600 vdcw; .937″ lg x .255″ diam; radial wire leads; dipped phenolic insulation; Centralab #BC32A; Fed Tele & Rad part/dwg #GH–2094–2–8.	
C–28,	C–28,	C–28,	V–4 tuning part of T–4.		
C–36,	C–36,	C–36,	V–5 tuning, part of T–5.		
C–103,	C–103,	C–103,	V–101, decoupling, bypass, part of T–101.		
C–127	C–127	C–127	V–104A decoupling, bypass, part of T–103.		
C–201	C–201	C–201	V–102 B+ decoupling.	CAPACITOR, fixed: electrolytic; 2 sect; plain and semicircle coded term and plain and sq coded term, ea 30 μf, tolerance ea sect −10% +150%; 150 vdcw ea sect; working temp range −40°C. to +85°C.; 1⅜″ diam x 2$\frac{1}{16}$″ max h excluding term and mtg tabs; HS metal can; 3 solder lug term on bottom; all term ins from can; 4 mtg tabs on bottom, ea $\frac{5}{16}$″ lg x .19″ wd x .032″ thk on .508″ rad 90 deg apart; Fed Tele & Rad part/dwg #GH–1189–2.	3DB30–61
C–144	C–144	C–144	Filament bypass. Section A: V–103 filament bypass. Section B: decoupling. Section C: V–106 filament bypass.	CAPACITOR, fixed: electrolytic; 3 sect; plain and triangular coded term and plain and sq coded term, ea 200 μf, plain and semicircle coded term 15 μf, tolerance all sect −10% +150%; 200 μf sect ea 10 vdcw, 15 μf sect 150 vdcw; working temp range −40°C. to +85°C.; 1⅜″ diam x 2$\frac{1}{16}$″ max h excluding term and mtg tabs; HS metal can; 4 solder lug term on bottom; all term ins from can; 4 mtg tabs on bottom ea $\frac{5}{16}$″ lg x .19″ wd x .032″ thk on .508 rad 90 deg apart; Fed Tele & Rad part/dwg #GH–1188–2.	3DB200–21
	C–75		V–11 antenna padder.	CAPACITOR, fixed: mica dielectric; $\mu\mu$f ±5%; 500 vdcw; JAN type CM20B240J.	3K2024022
	C–303	C–303	S–301 meter bypass.	CAPACITOR, fixed: mica dielectric; $\mu\mu$f ±10%; 500 vdcw; JAN type CM20B221K.	3K2022121
C–199	C–199	C–199	V–113 decoupling bypass.	CAPACITOR, fixed: mica dielectric; $\mu\mu$f ±5%; 500 vdcw; JAN type CM20B241J.	3K2024122

C–193, C–197	C–193, C–197	C 193, C–197	V–113 and V 114 diode load filter. V–115 de-emphasis network.	CAPACITOR, fixed: mica dielectric; 270 $\mu\mu$f ± 10%; 500 vdcw; JAN type CM20B271K.	3K2027121
C–206			V-104B, 1,600-cycle oscillator tuning.	CAPACITOR, fixed: mica dielectric; 1500 $\mu\mu$f ± 10%; 500 vdcw; JAN type CM30A152K.	3K3015211
C–303			Meter decoupling bypass.	CAPACITOR, fixed: mica dielectric; 470 $\mu\mu$f ± 10%; 500 vdcw; JAN type CM20A471K.	3K2047111
C–142, C–145	C–142, C–145	C 142, C–145	V–106 input coupling. V–105 input coupling.	CAPACITOR, fixed: mica dielectric; 1600 $\mu\mu$f ± 5%; 500 vdcw; JAN type CM30B162J.	3K3016222
C–72	C–72	C 72	V–11 screen bypass.	CAPACITOR, fixed: mica dielectric; 3300 $\mu\mu$f ± 10%; 500 vdcw; JAN type CM30B332K.	3K3033221
C–73	C–73	C–73	V–11 plate circuit bypass.	CAPACITOR, fixed: mica dielectric; 3,300 $\mu\mu$f ± 10%; 1200 vdcw; temp coef B; 53/64" sq x 11/32" thk; molded phenolic case; 2 axial wire leads; Fed Tele & Rad part/dwg #GH-2676-2.	3DA3.300 1
C–104	C–104	C 104	V–101 padder.	CAPACITOR, fixed: mica dielectric; 4700 $\mu\mu$f ± 10%; 500 vdcw; JAN type CM35D472K.	3K3547241
C–128	C–128	C 128	V–104A padder.	CAPACITOR, fixed: mica dielectric; 5100 $\mu\mu$f ± 5%; 500 vdcw; JAN type CM35D512J.	3K3551242
C–143	C–143	C–143	Tuning, 1600-cycle oscillator V–104A.	CAPACITOR, fixed: mica dielectric; 36,000 $\mu\mu$f ±1%; 300 vdcw; temp coef B; 1 5/8" lg x 1 1/8" wd x 29/64" thk; molded phenolic case; 2 solder lug term on sides; two .144" mtg holes on top on 1.312" mtg c; Fed Tele & Rad part/dwg #GH-2681-2.	3DA36
C–107, C–149, C–154, C–163, C–165, C–174, C–178, C–179, C–185, C–191	C–107, C–149, C–154, C–163, C–165, C–174, C–178, C–179, C–185, C–191	C–107, C–149, C–154, C–163, C–165, C–174, C–178, C–179, C–185, C–191	V–101 filament bypass. V–107 filament bypass. V–108 filament bypass. V–109 meter filter. V–109 filament bypass. V–108 filament bypass. V–111 filament bypass. V–110 filament bypass. V–111 filament bypass. V–113 and V–114 filament bypass.	CAPACITOR, fixed: paper dielectric; 10,000 $\mu\mu$f ± 20%; 120 vdcw; JAN type CN20E103M.	3DA10-380
C–108, C–110, C–114,	C–108, C–110, C–114,	C–108, C–110, C–114,	Coupling from discriminator to RETRANS AUDIO. Coupling from SQUELCH to RETRANS AUDIO. V–103 decoupling screen bypass.	CAPACITOR, fixed: paper dielectric; 10,000 $\mu\mu$f ±20%; 300 vdcw; JAN type CN22A103M.	3DA10–447

Ref symbol RT–66/GRC	Ref symbol RT–67/GRC	Ref symbol RT–68/GRC	Function of part	Name of part and description	Signal Corps stock No.
C–115, C–118, C–192, C–200, C–202, C–205	C–115, C–118, C–192, C–200, C–202,	C–115, C–118, C–192, C–200, C–202,	V–103, plate coupling to diode. V–103 decoupling, bypass. V–113 and V–114 coupling. V–115 filter bypass. Relay O–101 bypass. C–205: decoupling.		
C–203	C–203	C–203	V–115 decoupling bypass.	CAPACITOR, fixed: paper dielectric; 50,000 μμf ±20%; 300 vdcw; JAN type CN42A503M.	3DA50–435
C–194	C–194	C–194	V–113 and V–114 i-f bypass.	CAPACITOR, fixed: paper dielectric; 3 sect; ea sect .1 μf +20% −10%; 600 vdcw; JAN type CP69B5EF104V.	3DA100-673
C–141	C–141	C–141	V–104B plate bypass.	CAPACITOR, fixed: paper dielectric; .22 μf ±20%; 200 vdcw; HS metal can; .4″ OD x 1⅜″ lg; wax impr; 2 axial wire lead term at ends of can; mts by 2 axial wire leads 1⅝″ lg; Sprague #188P22402 or equal; Fed Tele & Rad part/dwg #GH-2355–12.	3DA220-9
C–1	C–1	C–1	Section A and B: V–1, r-f tuning. Section C and D: V–2, r-f tuning. Section E and F: V–6, r-f tuning. Section G and H: V–9, r-f tuning. Section J and K: V–11, r-f tuning. Section L and M: TRANS ANT coupling, r-f section.	CAPACITOR, variable: air dielectric; plate meshing type; 6 sect; sect A, 13–58 μμf; sect B and C, 15–88 μμf; sect D, 14–78 μμf, sect E and F, 14–68 μμf; all sect SLF characteristics; 1000 v RMS test; 5¼″ lg x 4⅝″ wd x 3$\frac{5}{16}$″ h; 2 rotor shafts geared to drive shaft ¼″ diam x 1$\frac{9}{16}$″ lg; lg drive shaft; scdr adj on 5 trimmers, shaft, w/worm gear drive adj on 6th; sect A, F, and E, 13 cad pl steel plates; sect D, 15 cad pl steel plates; sect B and C, 17 cad pl steel plates; 170 deg counterclockwise rotation; ceramic insulation; lug term; 3 mtg feet w/.169″ diam mtg holes on 3½″ x 4$\frac{13}{16}$″ mtg/c; 2 rotor shafts geared to driveshaft; RCC part #CN–800234; Fed Tele & Rad part/dwg #GH–1070–14.	3D9088V-1
C–17	C–17	C–17	Section A: V–3, plate tuning. Section B: V–4, plate tuning. Section C: V–5, plate tuning.	CAPACITOR, variable: air dielectric; plate meshing type; 3 sect; ea sect 14–88 μμf; all sect SLF characteristics; 1000 v RMS test; 3¾″ lg x 4.506″ wd x 2$\frac{5}{16}$″ h; 3 shafts, 2 rotor shafts geared to drive shaft having coupling w/hole $\frac{3}{16}$″ diam x $\frac{5}{16}$″ d; scdr adj; ea sect has 17 cad pl steel plates; 170 deg clockwise rotation; ceramic insulation; lug term; 3 mtg feet w/.15″ diam mtg hole on 2 front feet, #6–32 mtg hole on rear foot, 3½″ x 2.812″ mtg/c; RCC part #CN–800235; Fed Tele & Rad part/dwg #GH–1071–14.	3D9088V
	C–74		Transmitter antenna tuning.	CAPACITOR, variable: air dielectric; plate meshing type; single sect; 14–172 μμf; SLC characteristic; 1000 v RMS test; 2½″ lg x 1⅝″ sq, shaft 1.56″ diam x $\frac{21}{32}$″ lg; 19 cad pl steel plates; 180 deg clockwise rotation; ceramic insulation; lug term; three .112″–40 x ¼″ lg mtg studs on front 120 deg apart on $\frac{9}{16}$″ rad; butterfly type plates, tropicalized; RCC part CN–800237; Fed Tele & Rad part/dwg #GH–1072–2–1.	3D9172V

		C-74	Transmitter antenna tuning.	CAPACITOR, variable: air dielectric; plate meshing type; single sect; 12–138 $\mu\mu$f; SLC characteristic; 1000 v RMS test; 2 1/8″ lg x 1 5/8″ sq, shaft .156″ diam x 21/32″ lg; 15 cad pl steel plates; 180 deg clockwise rotation; ceramic insulation; lug term; three .112″–40 x 1/4″ lg mtg studs on front 120 deg apart on 9/16″ rad; butterfly type plates; tropicalized; RCC part #CN–800236; Fed Tele & Rad part/dwg #GH–1072–2–2.	3D9138V
C–74			Transmitter antenna tuning.	CAPACITOR, variable: air dielectric; plate meshing type; single sect; 20–216 $\mu\mu$f; SLC characteristic; 1000 v RMS test; 2 1/2″ lg x 1 5/8″ sq, shaft 1.56″ diam x 21/32″ lg; 23 cad pl steel plates; 180 deg clockwise rotation; ceramic insulation; lug term; three .112″–40 x 1/4″ lg thd mtg studs on front 120 deg apart on 9/16″ rad; butterfly plates; tropicalized; RCC part #CN–800238; Fed Tele & Rad part/dwg #GH–1072–2–3.	3D9216V–1
C–65	C–65	C–65	V–9 and V–10 trimmer.	CAPACITOR, variable: air dielectric; neutralizing; concentric type; .3–3 $\mu\mu$f; 1500 v AC peak; 1″ lg x 5/16″ diam excluding adj screw and term; term are single pigtail lead and mtg stud; one #12–24 x 7/32″ lg mtg stud; glass insulation; adj screw w/sedr slot; mtg stud 7/32″ lg flatted on 1 side to fit 1.83″ wd x .223″ lg "D" hole; Corning Glass code #690082 or equal; Fed Tele & Rad part/dwg #GH–1989–2–2.	3D9003V–19
C–101	C–101	C–101	Section A and B: V–101, i-f tuning. Section C and D: V–104A, i-f tuning Section E and F: V–2, i-f tuning. Section G and H: V–107, i-f tuning. Section J and K: V–108, i-f tuning. Section L and M: V–109, i-f tuning.	CAPACITOR: variable: air dielectric; plate meshing type; 6 sect; sect A, B, C, E, and F, ea 13.5–56.56 $\mu\mu$f; sect D, 16–67 $\mu\mu$f; all sect SLF characteristics; 1000 v RMS test v; 4 7/8″ lg x 4.23″ wd x 2.83″ h, 2 shafts 3/8″ diam x [illegible]″ lg; sedr adj, sect A, B, C, E, and F, 11 cad pl steel plates; sect D, 13 cad pl steel plates; 170 deg counterclockwise rotation; ceramic insulation; lug term; 3 mtg feet w/#6–32 mtg holes on 2 5/8″ x 4 1/2″ mtg/c; 2 rotor shafts geared together; RCC part CN–800233; Fed Tele & Rad part/dwg #GH–1056–14.	3D9069VEL6
C–16, C–26, C–33	C–16, C–26, C–33	C–16, C–26, C–33	V–3 trimmer. V–4 trimmer. V–5 trimmer.	CAPACITOR, variable: ceramic; 3 $\mu\mu$f to 12 $\mu\mu$f; 500 vdcw; JAN type CV11A120.	3D9012V–19
O–302			Dial drive assembly, Receiver-Transmitter RT–66/GRC.	CHANNEL SELECTOR GEAR HEAD ASSEMBLY: c o 1 Atlas Metal Stamping Co #BL–44830 housing assem, 1 ea #BA–43951, #BA–44165, #BA–44166, #BA–49590, #BA–49591, and #BL–44970 gear assem, 1 #BA–44965 support assem, 2 #BA–44171 spring assem, 1 ea #BA–38122 and #BA–38124 dial, and miscellaneous bearings, shafts, gears, plungers, and other small parts; rectangular w/1 rounded end; approx 8 3/8″ lg x 4 7/8″ wd x 3 1/8″ thk o/a; 5 mtg feet around outer edge of front side ea/w one .188″ diam mtg hole, 2 on 1 lengthwise edge on 3 3/8″ ctr, 3 on other lengthwise edge on 4 1/16″ and 3 7/16″ ctr respectively; 2 dials on front, 1 marked from 20–27 in units, other from 0–9, all markings luminous; 3 couplings and 1 notched gear extend from rear; Atlas Metal Stamping Co dwg #GA–2522–44–1; Fed Tele & Rad part/dwg #GA–2522–14–GR 1.	2C5130–66–1

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
	O–302		Dial drive assembly, Receiver-Transmitter RT–67/GRC.	CHANNEL SELECTOR GEAR HEAD ASSEMBLY: c/o 1 Atlas Metal Stamping Co #BL–44831 housing assem, 1 ea #BA–43951, #BA–44165, #BA–44166, #BA–49590, #BA–49591, and #BL–44975 gear assem, 1 #BA–44965, support assem, 2 #BA–44171 spring assem, 1 ea #BA–38122 and #BA–38123 dial, and miscellaneous bearings, shafts, gears, plungers, and other small parts; rectangular w/1 rounded end; approx 8⅜″ lg x 4⅞″ wd x 3⅛″ thk o/a; 5 meg feet around outer edge of front side ea w/one .188″ diam mtg hole, 2 on 1 lengthwise edge on 3⅜″ ctr, and 3 on other lengthwise edge on 4 7/16″ and 3 7/16″ ctr respectively; 2 dials on front, 1 marked from 27–38 in units, other from 0–9, all markings luminous; 3 couplings and 1 notched gear extend from rear; Atlas Metal Stamping Co dwg #GA–2522–14–2; Fed Tele & Rad part/dwg #GA–2522–14–GR II.	2C5130–67–1
		O–302	Dial drive assembly, Receiver-Transmitter RT–68/GRC.	CHANNEL SELECTOR GEAR HEAD ASSEMBLY: c/o 1 Atlas Metal Stamping Co #BL–44164 housing assem, 1 ea #BA–43951, #BA–44165, #BA–44166, #BA–49590, #BA–49591, and #BL–44169 gear assem, 1 #BA–44965 support assem, 2 #BA–44171 spring assem, 1 ea #BA–38122 and #BA–43979 dial, and miscellaneous bearings, shafts, gears, plungers, and other small parts; rectangular w/1 rounded end; approx 8⅜″ lg x 4⅞″ wd x 3⅛″ thk o/a; 5 mtg ft around outer edge of front side ea w/one .188″ diam mtg hole, 2 on 1 lengthwise edge on 3⅜″ ctr, and 3 on other lengthwise edge on 4 7/16″ and 3 7/16″ ctr respectively; 2 dials on front, 1 marked from 38–54 in units, other from 0–9, all markings luminous; 3 couplings and 1 notched gear extend from rear; Atlas Metal Stamping Co dwg #GA–2522–14–3; Fed Tele & Rad part/dwg #GA–2522–14–GR III.	2C5130–68–1
O–3	O–3	O–3	Tube grid contact cap.	CLIP: spring brass, cad pl; ⅞″ lg x ⅜″ h x 7/16″ wd o/a; uninsulated; 1 solder lug and wire clamping ears; fits ⅜″ diam receiving tube grid cond; spring loop type cont; Natl Co. catalog #24.	2Z2724
L–14, L–15	L–14, L–15	L–14, L–15	V–7 filament choke. V–8 filament choke.	COIL, RF: choke; single layer close wnd; unshielded; 5.3 μh at 1,000 cyc, 7.5 ohms DC resistance; 21 turns #33 AWG Wire; ⅝″ lg x 13/64″ diam; powdered iron core; two 1½″ lg axial wire leads; coated w/fungicidal varnish; Muter #C–7302; Fed Tele & Rad part/dwg #GN–1848–2.	3C345–2
	L–19,	L–19,	V–11 TRANS power amplifier grid choke.	COIL, RF: choke; single layer close wnd; unshielded; 8.1 μh at 1,000 cyc, .23 ohms DC resistance; 58 turns #26 formex wire; 1¾″ lg x 5/16″ diam excluding term; ceramic core; mts by 3/16″ ID of core; 2 solder lug term extend perpendicular to core at ends of core, ea w/⅛″ diam hole; coated w/fungicidal varnish; Muter #C–7310; Fed Tele & Rad part/dwg #GN–1849–2.	3C345–6
	L–20	L–20	V11–filament choke.		

L-2,	L-2,	L-2,	V-1 REC RF AMPLR plate load.	COIL, RF: choke; single layer close wnd; unshielded; 27.9 μh at 1,000 cyc, 1.13 ohms DC resistance; 65 turns #33 AWG wire; 5/8" lg x 5/16" diam; phenolic form w/powdered iron core; two 1½" lg axial wire leads; marked 30 μh; phenolic resin coated and wax impr; Muter #C-7305-1; Fed Tele & Rad part/dwg #GN-1314-12-1.	3C345-3
L-21	L-21	L-21	V-11 plate decoupling choke.		
L-4,	L-4,	L-4,	V-3 filament choke.	COIL, RF: choke; single wnd, progressively universal wnd; unshielded; 45 μh at 1,000 cyc, .82 ohms DC resistance; 75 turns #32 AWG wire; 5/8" lg x 5/16" diam; powdered iron core; two 1½" lg axial wire leads; marked 50 μh; phenolic resin coated and wax impr; Muter #C-7306; Fed Tele & Rad part/dwg #GN-1313-12.	3C345-4
L-5,	L-5,	L-5,	V-3 filament choke.		
L-122,	L-122,	L-122,	V-109 filament choke.		
L-135,	L-135,	L-135,	V-113 filament choke.		
L-136	L-136	L-136,	V-114 filament choke.		
L-7,	L-7,	L-7,	V-4 filament choke.	COIL, RF: choke; single layer close wnd; unshielded; 63 μh at 1,000 cyc, 1.9 ohms DC resistance; 95 turns #35AWG wire; 5/8" lg x 5/16" diam; powdered iron core; two 1½" lg axial wire leads; marked 70 μh; phenolic coated, wax impr, and phenolic covered; Muter #C-7307; Fed Tele & Rad part/dwg #GN-1312-12.	3C345-5
L-11,	L-11,	L-11,	V-6 filament choke.		
L-13,	L-13,	L-13,	V-8 filament choke.		
L-103,	L-103,	L-103,	V-101 plate choke, part of T-101.		
L-104,	L-104,	L-104,	V-101 filament choke.		
L-105,	L-105,	L-105,	V-101 filament choke.		
L-106,	L-106,	L-106,	V-101 filament choke.		
L-107,	L-107,	L-107,	V-103 filament choke.		
L-111,	L-111,	L-111,	V-104A filament choke, part of T103.		
L-116,	L-116,	L-116,	V-104B filament choke.		
L-125,	L-125,	L-125,	V-108 filament choke.		
L-128,	L-128,	L-128,	V-110 filament choke.		
L-131	L-131	L-131	V-111 filament choke.		
T-102	T-102	T-102	V-102 retransmit audio output coil.	COIL, RF: modulator; double wnd, 2 pie universal wnd; shielded; rectangular aluminum can; 1¼" lg x 1" wd x 1.906" h; phenolic form, powdered iron core; two #6-32 NC-2 mtg studs on diagonally opposite corners of base on .608" x .858" mtg/c; 6 solder lug term on bottom; marked GH-1620-12; tropicalized; Muter #C-7323; Fed Tele & Rad part/dwg #GH-1620-12.	3C1084Z81
T-101	T-101	T-101	V-101 receiver oscillator tuning.	COIL, RF: oscillator; 2 wnd, single layer wnd; rectangular aluminum shield can; 1.250" lg x 1" wd x 1.905" h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6-32 NC-2 x 3/8" lg mtg studs on diagonally opposite corners of base on .608" x .858" mtg/c; 6 solder term on bottom; marked GA-1677-12 on side of can; tropicalized; Fed Tele & Rad part/dwg #GA-1677-12.	2Z9629-245
T-103	T-103	T-103	V-104A transmitter oscillator tuning.	COIL, RF: oscillator; 2 wnd, single layer wnd; rectangular aluminum shield can; 1.250" lg x 1" wd x 1.905" h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6-32 NC-2 x 3/8" lg mtg studs on diagonally opposite corners of base on .608" x .858" mtg/c; 6 solder term on bottom; marked GA-1678-12 on side of can; tropicalized; Fed Tele & Rad part/dwg #GA-1678-12.	2Z9629-246

Ref symbol RT–66/GRC	Ref symbol RT–67/GRC	Ref symbol RT–68/GRC	Function of part	Name of part and description	Signal Corps stock No.
T–8			V–9 transmitter driver coil.	COIL, RF: 2 wnd, single layer wnd; unshielded; 6¾ turns #18 (.040″) wire ea wnd; 1 11/16″ wd x 1¾″ lg x 2⅜″ h o/a; ceramic form mtd on phenolic plate, powdered iron core; form 1 15/32″ lg x .650″ diam o/a; adj iron core and adj capacitor tuning; scdr adj at ends of coil and capacitor; two .169″ mtg holes on diagonally opposite corners of phenolic plate on 1.250″ x 1.250″ mtg/c; 6 solder type term on bottom of phenolic plate; stamped w/circuit symbol T–8 and w/term markings 8A, 8B, 8C, 8D, 8E, and 8F on bottom of phenolic plate; tropicalized; Fed Tele & Rad part/dwg #GA–2544–12–GR I.	2Z9629–242
	T–8		V–9 transmitter driver coil.	COIL, RF: 2 wnd, single layer wnd; unshielded; 4¾ turns #18 (.040″) wire ea wnd; 1 11/16″ wd x 1¾″ lg x 2⅜″ h o/a; ceramic form mtd on phenolic plate, powdered iron core; form 1 15/32″ lg x .650″ diam o/a; adj iron core and adj capacitor tuning; scdr adj at ends of coil and capacitor; two .169″ mtg holes on diagonally opposite corners of phenolic plate on 1.250″ x 1.250″ mtg/c; 6 solder type term on bottom of phenolic plate; stamped w/circuit symbol T–8 and w/term markings 8A, 8B, 8C, 8D, 8E, and 8F on bottom of phenolic plate; tropicalized; Fed Tele and Rad part/dwg #GA–2544–12–GR II.	2Z9629–244
		T–8	V–9 transmitter driver coil.	COIL, RF: 2 wnd, single layer wnd; unshielded; 3¾ turns #18 (.040″) wire ea wnd; 1 11/16″ wd x 1¾″ lg x 2⅜″ h o/a; ceramic form mtd on phenolic plate, powdered iron core; form 1 15/32″ lg x .650″ diam o/a; adj iron core and adj capacitor tuning; scdr adj at ends of coil and capacitor; two .169″ mtg holes on diagonally opposite corners of phenolic plate on 1.250″ x 1.250″ mtg/c; 6 solder type term on bottom of phenolic plate; stamped w/circuit symbol T–8 and w/term markings 8A, 8B, 8C, 8D, 8E, and 8F on bottom of phenolic plate; tropicalized; Fed Tele and Rad part/dwg #GA–2544–12–GR III.	2Z9629–243
T–3, T–4			V–3 harmonic generator plate tuning. V–4 harmonic generator plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; rectangular aluminum shield can; 1.250″ lg x 1″ wd x 2.093″ h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6–32 NC–2 x ⅜″ lg mtg studs on diagonally opposite corners of base on .608″ x .858 mtg/c; 6 solder term on bottom; marked GA–1613–12–1 on side of can; tropicalized; Fed Tele and Rad part/dwg #GA–1613–12–GR I.	3C1084K–100
	T–3		V–3 harmonic generator plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; rectangular aluminum shield can; 1.250″ lg x 1″ wd x 2.093″ h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6–32 NC–2 x ⅜″ lg mtg studs on diagonally opposite corners of base on .608″ x .858″ mtg/c; 6 solder term on bottom; marked GA–1613–12–2 on side of can; tropicalized; Fed Tele & Rad part/dwg #GA–1613–12–GR II.	3C1084K–101

		T–3	V–3 harmonic generator plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; rectangular aluminum shield can; 1.250″ lg x 1″ wd x 2.093″ h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6–32 NC–2 x ⅜″ lg mtg studs on diagonally opposite corners of base on .608″ x .858″ mtg/c; 6 solder term on bottom; marked GA–1613–12–3 on side of can; tropicalized; Fed Tele & Rad part/dwg #GA–1613–12–GR III.	3C1084K–102
	T–4		V–4 harmonic amplifier tuning.	COIL, RF: tuning; single wnd, single layer wnd; rectangular aluminum shield can; 1.250″ lg x 1″ wd x 2.093″ h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6–32 NC–2 x ⅜″ lg mtg studs on diagonally opposite corners of base on .608″ x .858″ mtg/c; 6 solder term on bottom; marked GA–1613–12–5 on side of can; tropicalized; Fed Tele & Rad part/dwg #GA–1613–12–GR V.	3C1084K–107
		T–4	V–4 harmonic amplifier tuning.	COIL, RF: tuning; single wnd, single layer wnd; rectangular aluminum shield can; 1.250″ lg x 1″ wd x 2.093″ h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6–32 NC–2 x ⅜″ lg mtg studs on diagonally opposite corners of base on .608″ x .858″ mtg/c; 6 solder term on bottom; marked GA–1613–12–6 on side of can; tropicalized; Fed Tele & Rad part/dwg #GA–1613–12–GR VI.	3C1084K–108
T–5			V–5 harmonic amplifier tuning.	COIL, RF: tuning; single wnd, single layer wnd; rectangular aluminum shield can; 1.250″ lg x 1″ wd x 2.093″ h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6–32 NC–2 x ⅜″ lg mtg studs on diagonally opposite corners of base on .608″ x .858″ mtg/c; 6 solder term on bottom; marked GA–1613–12–7 on side of can; tropicalized; Fed Tele & Rad part/dwg #GA–1613–12–GR VII.	3C1084K–109
		T–5	V–5 harmonic amplifier tuning.	COIL, RF: tuning; single wnd, single layer wnd; rectangular aluminum shield can; 1.250″ lg x 1″ wd x 2.093″ h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6–32 NC–2 x ⅜″ lg mtg studs on diagonally opposite corners of base on .608″ x .858″ mtg/c; 6 solder term on bottom; marked GA–1613–12–8 on side of can; tropicalized; Fed Tele & Rad part/dwg #GA–1613–12–GR VIII.	3C1084K–110
		T–5	V–5 second harmonic amplifier, plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; rectangular aluminum shield can; 1.250″ lg x 1″ wd x 2.093″ h excluding mtg studs and term; ceramic form, powdered iron core; adj iron core tuning; scdr adj thru top of can; two #6–32 NC–2 x ⅜″ lg mtg studs on diagonally opposite corners of base on .608″ x .858″ mtg/c; 6 solder term on bottom; marked GA–1613–12–9 on side of can; tropicalized; Fed Tele & Rad part/dwg #GA–1613–12–GR IX.	3C1084K–111
L–1			V–1 first receiver r-f tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 8½ turns, #20 tinned copper wire, tapped at 1½ turns; 1 21/32″ lg x ⅝″ diam o/a; ceramic form, air core; form .594″ OD x 1⅜″ lg; single "D" hole mtg, ⅜″–32 NC–2 x .1475″ lg mtg bushing w/locating flat; 3 stud term on side of form; Fed Tele & Rad part/dwg #GA–1626–12–GR I.	3C1084K–112

Ref symbol RT-66/GRC	Ref symbol RT-67/GRC	Ref symbol RT-68/GRC	Function of part	Name of part and description	Signal Corps stock No.
	L-1		V-1 first receiver r-f tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 6½″ turns silver pl copper 1/32″ wd x 1/16″ d plaited into threads of coil form, tapped at ½ turn; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1 3/8″ lg; single "D" hole mtg, 3/8″-32 NC-2 x .1475″ lg mtg bushing w/locating flat; 3 stud term on side of form; Fed Tele & Rad part/dwg #GA-1626-12-II.	3C1084K-89
		L-1	V-1 first receiver r-f tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 4¼ turns silver pl copper 1/32″ wd x 1/16″ d plaited into threads of coil form, tapped at ¾ turn; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1 3/8″ lg; single "D" hole mtg, 3/8″-32 NC-2 x .1475″ lg mtg bushing w/locating flat; 3 stud term on side of form; Fed Tele & Rad part/dwg #GA-1626-12-III	3C1084K-90
L-3			V-2 receiver mixer grid tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 8½ turns #20 tinned copper wire; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1 3/8″ lg; single "D" hole mtg, 3/8″-32 NC-2 x .1475″ lg mtg bushing w/locating flat; 2 stud term on side of form; Fed Tele & Rad part/dwg #GA-1626-12-GR IV.	3C1084K-91
	L-3		V-2 receiver mixer grid tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 6½ turns silver pl copper 1/32″ wd x 1/16″ d plaited into threads of coil form; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1 3/8″ lg; single "D" hole mtg, 3/8″-32 NC-2 x .1475″ lg mtg bushing w/locating flat; 2 stud term on side of form; Fed Tele & Rad part/dwg #GA-1626-12-GR V.	3C1084K-92
		L-3	V-2 receiver mixer grid tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 3¼ turns silver pl copper 1/32″ wd x 1/16″ d plaited into threads of coil form; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1 3/8″ lg; single "D" hole mtg, 3/8″-32 NC-2 x .1475″ lg mtg bushing w/locating flat; 2 stud term on side of form; Fed Tele & Rad part/dwg #GA-1626-12-GR VI.	3C1084K-93
L-12			V-6 transmitter mixer plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 7 5/8 turns #20 tinned copper wire; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1 3/8″ lg; single "D" hole mtg, 3/8″-32 NC-2 x .1475″ lg mtg bushing w/locating flat; 2 stud term on side of form; Fed Tele & Rad part/dwg #GA-1626-12-GR VII.	3C1084K-94
	L-12		V-6 transmitter mixer plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 5½ turns silver pl copper 1/32″ wd x 1/16″ d plaited into threads of coil form; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1 3/8″ lg; single "D" hole mtg, 3/8″-32 NC-2 x .1475″ lg mtg bushing w/locating flat; 2 stud term on side of form; Fed Tele & Rad part/dwg #GA-1626-12-GR VIII.	3C1084K-95

		L–12	V–6 transmitter mixer plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 3⅜ turns silver pl copper 1/32″ wd x 1/16″ d plaited into threads of coil form; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1⅜″ lg; single "D" hole mtg, ⅜″–32 NC–2 x .1475″ lg mtg bushing w/locating flat; 2 stud term on side of form; Fed Tele & Rad part/dwg #GA–1626–12–GR IX.	3C1084K 96
L–16			N 7 transmitter r-f plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 6¾ turns #20 tinned copper wire; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1⅜″ lg; single "D" hole mtg, ⅜″–32 NC–2 x .1475″ lg mtg bushing w/locating flat; 2 stud term on side of form; Fed Tele & Rad part/dwg #GA–1626–12–GR X.	3C1084K–97
	L–16		V–7 transmitter r-f plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 5 turns silver pl copper 1/32″ wd x 1/16″ d plaited into threads of coil form; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1⅜″ lg; single "D" hole mtg, ⅜″–32 NC–2 x .1475″ lg mtg bushing w/locating flat; 2 stud term on side of form; Fed Tele & Rad part/dwg #GA–1626–12–GR XI.	3C1084K–98
		L–16	V–7 transmitter r-f plate tuning.	COIL, RF: tuning; single wnd, single layer wnd; unshielded; 3⅛ turns silver pl copper 1/32″ wd x 1/16″ d plaited into threads of coil form; 1 21/32″ lg x 5/8″ diam o/a; ceramic form, air core; form .594″ OD x 1⅜″ lg; single "D" hole mtg, ⅜″–32 NC–2 x .1475″ lg mtg bushing w/locating flat; 2 stud term on side of form; Fed Tele & Rad part/dwg #GA–1626–12–XII.	3C1084K–99
T–9			V–11 transmitter amplifier plate tuning.	COIL ASSEMBLY, RF: plate tuning; c/o 1 Fed Tele & Rad #GA–2003–2 frame assem, 1 #GA–1996–2–G1 bkt assem, 1 #GB–2535–2 coupling, 1 #GA–2533–2 worm assem, 1 #GA–2536–2 coil, 1 #GA–2001–2 loop assem, miscellaneous hdw; 3″ lg x 2 5/8″ wd x 2 5/16″ h o/a; two .169″ mtg holes on bottom of frame on 7/8″ mtg/c; inductance between movable and fixed coil var by means of shaft and worm gear assem, between fixed coil and loop coil by means of shaft having scdr slot; Fed Tele & Rad part/dwg #GA–2005–14–I.	3C1084K–104
	T–9		V–11 transmitter power amplifier plate tuning.	COIL ASSEMBLY, RF: plate tuning; c/o 1 Fed Tele & Rad #GA–2003–2 frame assem, 1 #GA–1996–2–G2 bkt assem, 1 #GB–2535–2 coupling, 1 #GA–2533–2 worm assem, 1 #GB–2422–2–1 coil, 1 #GA–2001–2 loop assem, miscellaneous hdw; 3″ lg x 2 5/8″ wd x 2 1/16″ h o/a; two .169″ mtg holdes on bottom of frame on 7/8″ mtg/c; inductance between movable and fixed coil var by means of shaft and worm gear assem between fixed coil and loop coil by means of shaft having scdr slot; Fed Tele & Rad part/dwg #GA–2005–14–II.	3C1084K–105
		T 9	V–11 transmitter power amplifier tuning.	COIL ASSEMBLY, RF: plate tuning; c/o 1 Fed Tele & Rad #GA–2003–2 frame assem, 1 #GA–1996–2–G3 bkt assem, 1 #GB–2535–2 coupling, 1 #GA–2533–2 worm assem, 1 #GB–2422–2–2 coil, 1 #GA–2001–2 loop assem, miscellaneous hdw; 3″ lg x 2 5/8″ wd x 2 5/16″ h o/a; two .169″ mtg holes on bottom of frame on 7/8″ mtg/c; inductance between movable and fixed coil var by means of shaft and worm gear assem between fixed coil and loop coil by means of shaft having scdr slot; Fed Tele & Rad part/dwg #GA–2005–14–III.	3C1084K–106

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
O–303	O–303	O–303	Mounting and stop collar for flexible shaft.	COLLAR, shaft: p/o Fed Tele & Rad #GA–1593–14 panel assem; brass bright dip finish; round w/offset on 1 side face; ¾″ OD x .251″ ID x ¼″ thk o/a; mts on ¼″ shaft by ID, fastens by 2 set screws; has offset on 1 face to provide rotational stop action; Fed Tele & Rad part/dwg #GB–2452–2.	2Z2935–94
P–2	P–2	P–2	Transmitter oscillator coupling.	CONNECTOR, plug: single round male cont; straight, 21/64″ diam x 6½″ lg o/a incl cable; cylindrical silver pl brass body 39/64″ lg; teflon insert; push-on friction mtg; mts w/mating receptacle; supplied w/lg of Radio Frequency Cable RG 58/U attached to connector; Amphenol dwg #82–830; Fed Tele & Rad part/dwg #GH–2116–2–4.	2Z3021–221
P–1	P–1	P–1	Receiver mixer coupling.	CONNECTOR, plug: single round male cont; straight; 21/64″ diam x 7½″ lg o/a incl cable; cylindrical silver pl brass body 39/64″ lg; teflon insert; push-on friction mtg, mts w/mating receptacle; supplied w/lg of Radio Frequency Cable RG–58/U attached to connector; Amphenol dwg #82–830; Fed Tele & Rad part/dwg #GH–2116–2–5.	2Z3021–220
P–6	P–6	P–6	Transmitter antenna coupling.	CONNECTOR, plug: single round male cont; straight; 21/64″ diam x 9¼″ lg o/a incl cable; cylindrical silver pl brass body 39/64″ lg; teflon insert; push-on friction mtg, mts w/mating receptacle; supplied w/lg of Radio Frequency Cable RG–58/U attached to connector; Amphenol dwg #82–830; Fed Tele & Rad part/dwg #GH–2116–2–6.	2Z3021–219
P–304 through P–306, P–307, P–308	P–304 through P–306, P–307, P–308	P–304 through P–306, P–307, P–308	I-f chassis interconnecting plugs. R-f chassis interconnecting plugs.	CONNECTOR, plug: 15 round female cont; straight; 1½″ lg x ¾″ wd x .415″ h excluding term; rectangular phenolic body; two .15″ diam mtg holes on 1.188″ mtg/c; cont marked from 1–15; Amphenol dwg #26–150; Fed Tele & Rad part/dwg #GH–2126–12.	2Z3076–31
J–307	J–307	J–307	Antenna.	CONNECTOR, receptacle: single round female cont; straight; 1 9/32″ lg x 9/16″ diam o/a; cylindrical silver pl brass body; polyethylene insert; mts thru hole in panel, body has ⅜″–32 NEF–2 thd 11/32″ lg; O ring wp seal in panel bushing; supplied w/lockwasher and nut; Amphenol dwg #31–102; Fed Tele & Rad part/dwg #GH–2118–2.	2Z3062–233
J–101, J–102,	J–101, J–102,	J–101, J–102,	First mixer lead connector. Transmitter oscillator lead connector.	CONNECTOR, receptacle: single round female cont; straight; 15/16″ lg x ½″ diam o/a; cylindrical silver pl brass body; teflon insert; single hole mtg ⅜″–32 NF–2 bushing 3/16″ lg; supplied w/lockwasher and nut; Amphenol dwg #82–831; Fed Tele & Rad part/dwg #GH–2117–2.	2Z3062–232
J–306	J–306	J–306	Antenna lead connector.		
J–312	J–312	J–312	Control cable connector.	CONNECTOR, receptacle: 9 round female cont; straight; 1 15/32″ diam x 1⅛″ max lg o/a; cont rated 10 amp at 800 v AC; cylindrical brass body, electro tin pl finish locking; molded phenolic insert; single hole mtg 1¼″–18	2Z3070–49

				NEF–2 x ⅜″ lg mtg bushing; O ring wp seal in mtg fl, supplied w/spanner type mtg nut and lockwasher; immersion and salt spray resistant; 2 index flats on mtg bushing; ¼″–20 double thd tapped metal insert in ctr of phenolic insert provides locking action w/mating plug; locating key in shell and groove in insert; Amphenol dwg #164–3; Fed Tele & Rad part/dwg #GH–2082–12.	
J–310, J–311	J–310, J–311	J–310, J–311	Audio connectors.	CONNECTOR, receptacle: 10 round button type cont; straight; 1.286″ max diam x 1.197″ max o/a; cylindrical SS body, sand blast finish, locking; molded phenolic insert; single hole mtg, 1″–32 NS–2 x 5/16″ lg thd mtg bushing; O ring wp seal on mtg fl, supplied w/spanner type mtg nut; immersion and salt spray resistant; index flats on mtg portion; Amphenol dwg #164–7 or Cannonelec dwg #17651–1; Fed Tele & Rad part/dwg #GH–2079–12.	2Z3030–27
J–309	J–309	J–309	Power connector.	CONNECTOR, receptacle: 14 round female cont; straight; 1.750″ diam x 1 1/8″ lg o/a; cont rated 10 amp at 800 v AC; cylindrical brass body, electro tin pl finish, locking; molded phenolic insert; single hole mtg, 1⅝″–18 NEF–2 x ⅜″ lg mtg bushing; O ring wp seal in mtg fl, supplied w/spanner type mtg nut and lockwasher; immersion and salt spray resistant; 2 index flats on mtg bushing; ¼″–20 double thd tapped metal insert in ctr of phenolic insert provides locking action w/mating plug; locating key in outer shell and groove in insert; Amphenol dwg #164–5; Fed Tele & Rad part/dwg #GH–2083–12.	2Z3075–26
J–4 through J–108	J–4 through J–108	J–4 through J–108	Front panel interconnecting receptacles.	CONNECTOR, receptacle: 15 round male cont; straight; 1 1/2″ lg x 3/4″ wd x 13/64″ h excluding term and cont; rectangular phenolic body; two .150″ diam mtg holes on 1.188″ mtg/c; cont marked from 1–15; Amphenol dwg #26–151; Fed Tele & Rad part/dwg #GH–2127–12.	2Z3035–31
O–15,	O–15,	O–15,	Adjustable tuning core, part of T–1.	CORE, adjustable tuning: c o 1 Fed Tele & Rad #GH–1542–2–1 tuning core, 1 #GB–1622–2 nut, and 1 #GB–2709–2 nut; cylindrical core w/thd stud mtd thru hex nut; 1 19/64″ lg x 1/2″ across flats of hex portion; mts by means of 3/8″–32 NC–2 x 3/16″ d tapped hole in hex mtg nut; scdr adj slot in end of thd stud; Fed Tele & Rad part/dwg #GA–1749–2.	2Z3262–47
O–16,	O–16,	O–16,	Adjustable tuning core, part of T–2.		
O–17,	O–17,	O–16,	Adjustable tuning core, part of T–6.		
O–18	O–18	O–18	Adjustable tuning core, part of T–7.		
O–401	O–401	O–401	Dial drive to capacitor coupling	COUPLING, flexible: c o 1 Fed Tele & Rad #GB–1630–12 spider, 1 #GB–1631–2–1 cap, 1 #GB–1632–2 bellows, 1 #GB–2741–2 sleeve, 1 #GA–2743–12 gear assem, and 2 set screws; 1.154″ max diam x 1¼″ lg o/a; .189″ diam mtg hole in cap end, and 36 axial teeth and three .140″ mtg holes on .437″ rad, 120 deg apart in gear end; rotating spider locking arrangement to provide locking w/matching gear on dial drive assem; Fed Tele & Rad part/dwg #GA–1640–14–1.	2Z3295–128

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
O–402	O–402	O–402	Dial drive to capacitor coupling.	COUPLING, flexible: c/o 1 Fed Tele & Rad #GB–1630–12 spider, 1 #GB–6131–2–2 cap, 1 #GB–1632–2 bellows, 1 #GB–2741–2 sleeve, 1 #GA–2743–12 gear assem, and 2 set screws; 1.154″ max diam x 1¼″ lg o/a; .257″ diam mtg hole in cap end, and 36 axial teeth and three .140″ mtg holes on .437″ rad, 120 deg apart in gear end; rotating spider locking arrangement to provide locking w/matching gear on dial drive assem; Fed Tele & Rad part/dwg #GA–1640–12–2.	2Z3295–129
O–403	O–403	O–403	Dial drive to capacitor coupling.	COUPLING, flexible: c/o 1 Fed Tele & Rad #GB–1630–12 spider, 1 #GB–2673–2 cap, 1 #GB–1632–2 bellows, 1 #GB–2712–2 sleeve, 1 #GA–2743–12 gear assem, and 2 cap screws; 1.154″ max diam 1¼″ lg o/a; .377″ diam mtg hole in cap end, and 36 axial teeth and three .140″ mtg holes on .437″ rad, 120 deg apart in gear end; rotating spider locking arrangement to provide locking w/matching gear on dial drive assem; Fed Tele & Rad part/dwg #GA–1640–12–3.	2Z3295–131
O–102	O–102	O–102	I-f variable capacitor to shaft coupling.	COUPLING, flexible: c/o 1 ea Fed Tele & Rad #GB–1631–2–2 and #GB–1631–2–3 caps, 1 #GB–1632–2 bellows, and 4 set screws; ⅝″ diam x 1 3/16″ lg o/a; 1 end cap has .257″ diam mtg hole, other end cap .377″ diam mtg hole; ea end cap has 2 set screws; Fed Tele & Rad part/dwg #GA–2377–12.	2Z3295–130
A–301	A–301	A–301	Dial drive and detent adjustable access hole cover.	COVER: c/o 1 Fed Tele & Rad #GT–3088–12 cover, 2 #GA–3068–2 knobs, 1 #GT–3080–2 lamp cover, 1 #GR–3028–2 and 2 #GR–3029–2 "O" rings, 2 #GP–3092–2 lens, 1 ea #GB–3032–2 and #GB–3033–2 lens retainer, 2 #GA–3067–12 studs, 2 ea #GB–3070–2 and #GB–3071–2 washers, 2 #GB–3069–2 stops, and 2 #GB–3072–2 springs; kidney shaped; approx 8 21/32″ lg x 4 13/32″ wd x 1 3/32″ thk o/a; fourteen .128″ diam mtg holes around outer edge, on irregular spacing; marked "MCS" and "TENTH MCS"; Fed Tele & Rad part/dwg #GA–3087–12.	2Z3351–205
A–302	A–302	A–302	Pilot lamp access hole cover.	COVER: c/o 1 Fed Tele & Rad #GC–3030–2 lamp cover and 1 #GT–3081–2 decal; aluminum casting, olive drab finish; rectangular shape; 2 15/32″ lg x ¾″ wd x .212″ thk; two .169″ diam mtg holes on 2″ mtg/c; marked "LAMP"; oval shoulder and groove on back side for "O" ring gasket; Fed Tele & Rad part/dwg #GT–3080–2.	2Z3351–206
		Y–4	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6091.666 kc; Sig C spec #71–3314.	2X209–6091.666
Y–4			Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6183.333 kc.	2X209–6183.333

		Y–5	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6258.333 kc.	2X209–6258.333
		Y–6	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6425.000 kc.	2X209–6425
Y–5			Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6516.666 kc.	2X209–6516.666
		Y–7	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6591.666 kc.	2X209–6591.666
		Y–8	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6758.333 kc.	2X209–6758.333
Y–6			Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6850.000 kc.	2X209–6850
	Y–6		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6887.500 kc.	2X209–6887.5
		Y–9	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 6925.000 kc.	2X209–6925
		Y–10	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7091.666 kc.	2X209–7091.666
	Y–7		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7137.500 kc.	2X209–7137.5
Y–7			Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7183.333 kc.	2X209–7183.333
		Y–11	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7858.333 kc.	2X209–7258.333
	Y–8		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7387.500 kc.	2X209–7387.5
		Y–12	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7425.000 kc.	2X209–7425
Y–8	Y–1		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7516.666 kc.	2X209–7516.666
		Y–13	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7591.666 kc.	2X209–7591.666

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
	Y–9		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7637.500 kc.	2X209–7637.5
		Y–14	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7758.333 kc.	2X209–7758.333
Y–1			Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7775.000 kc.	2X209–7775
	Y–2		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7850.000 kc.	2X209–7850
	Y–10		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7887.500 kc.	2X209–7887.5
		Y–15	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 7925.000 kc.	2X209–7925
		Y–16	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 8091.666 kc.	2X209–8091.666
	Y–11		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 8137.500 kc.	2X209–8137.5
	Y–3		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 8183.333 kc.	2X209–8183.333
		Y–17	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 8258.333 kc.	2X209–8258.333
Y–2			Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig. C Crystal Holder HC–6/U; nom freq 8275.000 kc.	2X209–8275
	Y–12	Y–1	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 8387.500 kc.	2X209–8387.5
	Y–4		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 8516.666 kc.	2X209–8516.666
		Y–2	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 8637.500 kc.	2X209–8637.5
Y–3			Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–18/U; single xtal plate in Sig C Crystal Holder HC–6/U; nom freq 8775.000 kc.	2X209–8775

	Y-5		Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR-18/U; single xtal plate in Sig C Crystal Holder HC-6/U; nom freq 8850.000 kc.	2X209-8850
		Y 3	Oscillator element	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR-18/U; single xtal plate in Sig C Crystal Holder HC-6/U; nom freq 8887.500 kc.	2X209-8887.5
CR-301	CR 301	CR 301	R-f metering diode	CRYSTAL UNIT, rectifying: JAN type 1N69	2J1N69
H-301 through H-308	H 301 through H 308	H-301 through H 308	Panel-to-case fasteners	FASTENER, Dzus: die cast zinc and steel, olive drab finish; 1⅝" lg x 15/16" wd x 5/16" thk o/a; mts by shaft thru ¼" diam clearance hole; pre-loaded spring pressure unlocked approx 32 lb, locked 45 lb; Dzus dwg #X-486; Fed Tele & Rad part/dwg #GA-2178-2.	6Z3809-27
O-310	O-310	O-310	Panel-to-case waterproof gasket.	GASKET: Buna N or neoprene; single hole; rectangular; 10.532" lg x 8.345" wd x .187" thk; hole 10.052" lg x 7.865" wd; 35–40 durometer hardness; p/o Fed Tele & Rad #GA-1593-14 panel assem; Fed Tele & Rad part/dwg #GR-1443-12-4.	2Z4868.763
O-312	O-312	O-312	Dial drive access cover waterproof gasket.	GASKET: JW60 crude rubber; single hole; circular w/circular cross section; 6½" OD x 6¼" ID x ⅛" thk; p/o Fed Tele & Rad #GA-1593-14 panel assem; Linear Inc #1866-37; Fed Tele & Rad part/dwg #GS-1946-1-1.	2Z4868.766
O-313	O-313	O-313	Binding post waterproof mounting gasket.	GASKET: Buna N; single hole; circular w/circular cross section; 9/32" OD x 5/32" ID x 1/16" thk; p/o Fed Tele & Rad #GA-1593-14 panel assem; Linear Inc #1820-2; Fed Tele & Rad part/dwg #GS-1948-1-15.	6L34005
O-314, O-315	O-314, O-315	O-314, O-315	Shaft assembly waterproof mounting gaskets.	GASKET: Buna N; single hole; circular w/circular cross section; ⅜" OD x ¼" ID x 1/16" thk; p/o Fed Tele & Rad #GA-1593-14 panel assem; Linear Inc #1820-5; Fed Tele & Rad part/dwg #GS-1948-1-4.	2Z4868.767
O-316	O-316	O-316	Binding post waterproof mounting gasket.	GASKET: Buna N; single hole; circular w/circular cross section; 7/16" OD x 5/16" ID x 1/16" thk; p/o Fed Tele & Rad #GA-1593-14 panel assem; Linear Inc #1820-6; Fed Tele & Rad part/dwg #GS-1948-1-5.	2Z4868.768
O-319	O-319	O-319	Adjustable plunger cap waterproof gasket.	GASKET: Buna N; single hole; circular w/circular cross section; 11/16" OD x ½" ID x 3/32" thk; p/o Fed Tele & Rad #GA-1593-14 panel assem; Linear Inc #1820-10; Fed Tele & Rad part/dwg #GS-1948-1-16.	2Z4868.764
O-320	O-320	O-320	Pilot lamp cover waterproof gasket.	GASKET: Buna N; single hole; circular w/circular cross section; 1.233" OD x 1.093" ID x .07" thk; p/o Fed Tele & Rad #GA-1345-12 cover assem; Fed Tele & Rad part/dwg #GR-3028-2.	2Z4868.765
O-311	O-311	O-311	Meter mounting waterproof gasket.	GASKET: Buna N; 1 hole; circular w/circular cross section; 1½" OD x 1¼" ID x ⅛" thk; Linear Inc #1820-23; Fed Tele & Rad part/dwg #GS-1948-1-14.	2Z4868.737

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
O–13	O–13	O–13	Crystal switch driven gear.	GEAR: spur type; brass, acid dip finish; straight teeth; 48 teeth; 48 pitch, 1″ pitch diam; 1.04″ OD x .251″ ID x 3/8″ thk o/a; straight face; hub 1/2″ OD x 1/4″ lg; mts on 1/4″ diam shaft; p/o Fed Tele & Rad #GA–1515–12 parts 1, 2, and 3 switch assem; Boston Gear catalog #G142; Fed Tele & Rad part/dwg #GB–1481–2.	2C4410E/G9
	O–14		Crystal switch driven gear.	GEAR: spur type; brass, acid dip finish; straight teeth; 48 teeth; 48 pitch, .958″ pitch diam; .998″ OD x .251″ ID x 3/8″ thk; straight face; hub 7/16″ diam x 1/4″ lg; mts on 1/4″ diam shaft, two #6–32 NC–2 tapped holes in hub 90 deg apart; p/o Fed Tele & Rad #GA–1515–12–2 swtch assem; Fed Tele & Rad part/dwg #GB–1495–2.	2Z4878–1161
		O–14	Crystal switch driven gear.	GEAR: spur type; brass, acid dip finish; straight teeth; 48 teeth; 48 pitch, .646″ pitch diam; .686″ OD x .251″ ID x 3/8″ thk; straight face; hub 7/16″ diam x 1/4″ lg; mts on 1/4″ diam, shaft two #6–32 NC–2 tapped holes in hub 90 deg apart; p/o Fed Tele & Rad #GA–1515–12–3 switch assem; Fed Tele & Rad part/dwg #GB–1496–2.	2Z4878–1163
O–14			Crystal switch driven gear.	GEAR: spur type; brass, acid dip finish; straight teeth; 48 teeth; 48 pitch, .667″ pitch diam; .707″ OD x .251″ ID x 3/8″ thk; straight face; hub 7/16″ diam x 1/4″ lg; mts on 1/4″ diam shaft, two #6–32 NC–2 tapped holes in hub 90 deg apart; p/o Fed Tele & Rad #GA–1515–12–1 switch assem; Fed Tele & Rad part/dwg #GB–1497–2.	2Z4878–1162
O–4	O–4	O–4	Capacitor assembly drive gear assembly.	GEAR ASSEMBLY: p/o Fed Tele & Rad #GA–1897–12 capacitor assem; c/o 1 Fed Tele & Rad #GB–1885–2 gear, 1 #GB–1886–2 anchor, 1 #GB–1894–2 arm, and 2 set screws; approx 3/4″ lg x 7/16″ wd x 9/16″ d o/a; mtg hole thru ctr of gear .156″ diam, mts on shaft by means of 2 set screws, gear has 18 teeth, 48 pitch; Fed Tele & Rad part/dwg #GA–1890–2.	2Z4875–366
O–5	O–5	O–5	Capacitor assembly drive gear segment assembly.	GEAR ASSEMBLY: p/o Fed Tele & Rad #GA–1897–12 capacitor assem; c/o 1 #GC–1895–2 gear segment, 1 #GB–1893–2 pin, and hdw; approx 1 7/8″ lg x 1 3/32″ wd 27/32″ d o/a; .189″ diam mtg hole, mts on shaft; gear segment has 10 teeth; Fed Tele & Rad part/dwg. #GA–1882–2.	2Z4875–365
E–11 through E–23	E–11 through E–23	E–11 through E–23	Relay lead insulators.	INSULATOR, bead: fish spine bead shape; white ceramic, unglazed; 1/8″ max lg; 1/8″ max OD x .056″ ID; rounded on front end; cupped .036″ max d on rear end; AlSiMag catalog #W–2602, or Stupakoff catalog #78.0018; Fed Tele & Rad part/dwg #GG–2524–2.	3G80–1
E–25 through E–42,	E–25 through E–42,	E–25 through E–42,	Feedthrough, wiring terminal posts.	INSULATOR, feedthru: cylindrical shape; white grade L–4 steatite, unglazed; 1 3/32″ lg o/a; .187″ o/a diam; mts in .168″ diam hole; c/o 1 Fed Tele & Rad #GB–1587–2–1 term, 2 #GG–1589–2 ceramic bushings, 1	3G290–19

E–302, E–303	E–302, E–303	E–302, E–303		#GR–1588–2 silicon rubber grommet, and 1 #GB–1590–2–1 eyelet, supplied unassembled; Fed Tele & Rad part/dwg #GA–1584–2.	
E–301	E–301	E–301	Wiring terminal post	INSULATOR, standoff: round post shape; natural or black grade LTS–E–4 phenolic w/electro tin pl brass term lug, and cad pl and clear iridiated hex brass mtg base and stud; 13/16″ lg o/a; 600 v RMS breakdown; 5/16″ diam o/a; single #6–32 NC–2 x 1/4″ lg mtg stud; p/o Fed Tele & Rad #GA–1593–14 panel assem; Cambridge Therm #X–1518–B; Fed Tele & Rad part/dwg #GN–2198–2.	3G350–106
E–43 through E–65, E–120 through E–156	E–43 through E–65, E–120 through E–156	E–43 through E–65, E–120 through E–156	Standoff, wiring terminal posts.	INSULATOR, standoff: round post shape; white unglazed ceramic w/metal end caps; .6″ lg; .209″ diam; ceramic, silicon treated; rivet type mtg stud on 1 end cap .094″ diam x .1″ lg, solder type stud term other cap; Fed Tele & Rad part/dwg #GG–1743–2–2.	3G350–110
E–24	E–24	E–24	Terminal mounting insulator.	INSULATOR, standoff: round post shape; grade L–2 white ceramic, glazed; 1/2″ lg; 3/8″ diam; both ends tapped #8–32 NC–2 thd 3/16″ d; treated w/GE dri-film #0977 or Dow-Corning #DC–200; p/o #GA–1672–14 RF chassis assem; Fed Tele & Rad part/dwg #GG–2101–2.	3G350–109
E–304, E–305	E–304, E–305	E–304, E–305	VOLUME control knob. DIAL LIGHT-OFF-ON-RING switch knob.	KNOB: round w/bar; olive drab, zinc alloy; for 1/4″ diam double flatted shaft; single #6–32 screw thru hole in face of knob screws into axially tapped hole in end of shaft; 1 white luminous line on bar portion; 1 3/16″ lg x 7/8″ wd x 15/32″ h o/a; shaft hole .359″ d from bottom surface; luminous markings; Fed Tele & Rad part/dwg #GC–1246–2	2Z5822–402
E–306	E–306	E–306	METER switch knob	KNOB: round w/bar; olive drab, zinc alloy; for 1/4″ diam double flatted shaft; single #6–32 screw thru hole in face of knob screws into axially tapped hole in end of shaft; 1 white luminous line on bar portion; 1 3/16″ lg x 7/8″ wd x 15/32″ h o/a; shaft hole .359″ d from bottom surface; luminous markings; Fed Tele & Rad part/dwg #GC–1690–2.	2Z5822–401
E–309	E–309	E–309	SQUELCH-OFF control knob.	KNOB: round; olive drab zinc alloy; for 1/4″ diam double flatted shaft; single #6–32 screw thru hole in face of knob screws into axially tapped hole in end of shaft; 1 white luminous line; 23/32″ max diam at bottom tapers to 21/32″ max diam at top; 15/32″ h o/a; shaft hole .359″ from bottom surface; luminous markings; Fed Tele & Rad part/dwg #GC–1245–2.	2Z5822–403
N–1			Circuit label, Receiver-Transmitter RT–66/GRC.	LABEL: circuit label; white nylon taffeta, 120 x 88 mesh; 7 3/4″ wd x 26 3/4″ lg x .004″ thk, w/1/4″ wd nylon tape stitched to 1 end extending 16 1/4″ beyond label; black printing on white background; edges heat treated to prevent fraying; individually packed; Fed Tele & Rad part/dwg #GD–1795–26; Sig C dwg #SC–D–40607–A.	6D16838

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT-66/GRC	RT-67/GRC	RT-68/GRC			
	N-1		Circuit label, Receiver-Transmitter RT-67/GRC.	LABEL: circuit label; white nylon taffeta, 120 x 88 mesh; 7¾″ wd x 26¾″ lg x .004″ thk, w/¼″ wd nylon tape stitched to 1 end extending 16¼″ beyond label; black printing on white background; edges heat treated to prevent fraying; individually packed; Fed Tele & Rad part/dwg #GD-2948-26; Sig C dwg #SC-D-40608-A.	6D16838-1
		N-1	Circuit label, Receiver-Transmitter RT-68/GRC.	LABEL: circuit label; white nylon taffeta, 120 x 88 mesh; 7¾″ wd x 26¾″ lg x .004″ thk, w/¼″ wd nylon tape stitched to 1 end extending 16¼″ beyond label; black printing on white background; edges heat treated to prevent fraying; individually packed; Fed Tele & Rad part/dwg #GD-2949-26; Sig C dwg #SC-D-40609-A.	6D16838-2
E-313	E-313	E-313	Dial illuminating lamp.	LAMP, incandescent: 1.35 v, .06 amp; bulb T-1¾ clear; ⅝″ lg; single cont midget flanged base; C-6 tungsten fil; burn any position; GE #331; Fed Tele & Rad part/dwg #GH-1992-2.	2Z5877-21
J-313	J-313	J-313	Dial lamp socket.	LAMPHOLDER: for single cont midget flange base lamp; phenolic board w/metal cont clips and term; 1⅜″ lg x ¾″ wd x 19/32″ thk o/a; two .128″ diam ctb mtg holes on 5/16″ mtg/c; term at top side of mtg board; p/o Fed Tele & Rad #GA-1593-14 panel assem; Fed Tele & Rad part/dwg #GA-2228-2.	2Z5956.29
M-301	M-301	M-301	Filament voltage and power output metering.	METER, arbitary scale: Sig C type MR135001 DCMA or MR1551D1DCAV; DC; range 0-1 ma; round plastic or metal panel mtg case, w/sq mtg fl; 1½″ max diam case, 13/16″ d behind fl; 1¾″ sq fl, .334″ thk; accuracy ±3%; 100 mv drop across term; calibrated for nonmagnetic panel; 10 white scale divisions on black background; first ctr and last scale mark and ¼″ tip of pointer are luminescent; self-contained; four .122″ diam mtg holes on 1.312″ x 1.312″ mtg/c; four #4-40 machine screw arc incl, screws extend ¼″ x .000″-.03125″ behind fl nut and lockwasher on ea screw to hold face pl on meter during shipment, to be removed at assem; 2 solder lug term on back of case; moisture resistant and wp, w/external black phenolic face plate w/red are over ctr of scale opening; Weston Model #1011 or Simpson Elec spec #3086; Fed Tele & Rad part/dwg #GT-3141-2.	3F3299-16
H-309,	H-309,	H-309,	VOLUME control mounting nut.	NUT, castellated: steel, cad pl and olive drab iridite; finished per dwg; ⅜″-32 NS-2 x ⅛″ thk; 5/16″ OD; 4 slots 3/32″ wd x 3/64″ d spaced 90 deg apart; p/o Fed Tele & Rad #GA-1593-14 panel assem; Fed Tele & Rad part/dwg #GB-1106-2.	6L3006-32S
H-310,	H-310.	H-310,	METER switch mounting nut.		
H-311,	H-311,	H-311,	DIAL LIGHT-OFF-ON-RING switch mounting nut.		
H-312	H-312	H-312	SQUELCH-OFF control mounting nut.		

J–308	J–308	J–308	Auxiliary connector.	POST, binding: push type; $^{33}/_{64}$" diam x $^{49}/_{64}$" lg above mtg surface; $^{3}/_{4}$" lg x #6–32 NC–2 thd mtg stud; phenolic cap, nickel pl brass body; $^{1}/_{8}$" diam wire hole; "D" shaped wire grip hole in cap; Eby catalog #8330; Fed Tele & Rad part/dwg #GM–2253–2.	3Z737–57
A–101	A–101	A–101	Audio reactor supporting post.	POST, supporting: toroid coil supporting post; brass, bright dip finish; hexagon post shape; $^{5}/_{8}$" lg x $^{3}/_{8}$" across flats; thd hole axially thru ctr, #8–32 NC–2 thd; Fed Tele & Rad part/dwg #GB–3093–2.	2Z7259–82
L–108	L–108	L–108	V–103 squelch reactor.	REACTOR: audio; dual; term 1 and 2, 225–250 mh; term 3 and 4, 275–310 mh; term 1 and 2, 270 ohms; term 3 and 4, 280 ohms DC resistance; 500 v RMS test; HS metal case; $1^{3}/_{8}$" lg x $^{7}/_{8}$" wd x $2^{1}/_{2}$" h o/a; two .128" diam mtg holes on $1^{1}/_{8}$" mtg/c; 5 solder type stud term on bottom of case; electrostatic shield between sect; Fed Tele & Rad part/dwg #GH–1226–2.	3C315–153
L–137	L–317	L–137	V–105 microphone filter choke.	REACTOR: audio reactor; 100 mh min; 30 ma DC; 13.5 ohms ±5% DC resistance; not cased; 800 turns #31 formuar wire; $1^{3}/_{8}$" OD x $^{1}/_{4}$" ID x $^{5}/_{8}$" thk; mts by means of ctr hole; 2 solder lug term on side of coil; tropicalized; Fed Tele & Rad part/dwg #GH–3085–2.	3C315–154
O–301	O–301	O–301	Antenna transfer	RELAY, armature: cont arrangement 1C; cont rating lamp at 40 v DC; $^{1}/_{16}$" diam palladium cont; single wnd; 6 v DC, pulls in at 4 v DC, max oper v 8 v DC, 39 ±3 ohms, noninductive wnd insulated; solder lug term on coil and cont; $1^{3}/_{4}$" lg x 1" wd x $1^{9}/_{16}$" h o/a; two #6–32 NC–2 mtg holes on back side on $^{3}/_{4}$" mtg/c; fast acting; impr for tropical use; Dunco #181XAX100 or equal; Fed Tele & Rad part/dwg #GH–1604–12, spec #GS–1315–2.	2Z7599A–243
O–1	O–1	O–1	H-v relay	RELAY, armature: cont arrangement 3A; cont rating between term 2 and 3, 60 ma at 300 v DC; term 4 and 5, 25 ma at 500 v DC; term 6 and 7, 10 ma at 150 v DC; palladium cont; single wnd, 6 v DC, pulls in at 4 v DC, max oper v 8 v DC; 39 ±3 ohms, noninductive wnd, insulated; coil and cont leads terminate in solder lug term on bottom of can; $1^{5}/_{8}$" lg x $1^{7}/_{16}$" wd x $2^{5}/_{16}$" h o/a; three #6–32 x $^{1}/_{4}$" lg mtg studs on $^{15}/_{16}$" x $1^{3}/_{16}$" mtg/c; fast acting; HS metal can; term #1 marked w/brown dot, ckt diagram, and part number on can; Adv Elec #A8769–1Y or Dunco #181CXX100; Fed Tele & Rad part/dwg #GH–1360–2, spec #GS–1315–2.	2Z7599A–242
O–101	O–101	O–101	Transmitter-receiver relay.	RELAY, armature: cont arrangement 2A2C; cont rating between term 1 and 2, and 2 and 3 ea 5 ma at 100 v DC; 4 and 5, 2000 ma at 50 v DC; 6 and 7, 80 ma at 50 v DC; 8 and 9, 40 ma at 150 v DC; and 9 and 10, 10 ma at 150 v DC; palladium cont; single wnd, 6 v DC, pulls in at 4 v DC, max oper v 8 v DC; 39 ±3 ohms, noninductive wnd, insulated; coil and cont terminate in solder lug term on bottom of can; $1^{5}/_{8}$" lg x $1^{7}/_{16}$" wd x $2^{5}/_{16}$" h o/a; three #6–32 x $^{1}/_{4}$" lg mtg studs on $^{15}/_{16}$" x $1^{3}/_{16}$" mtg/c; fast acting; HS metal can; term #1 marked w/brown dot, ckt diagram and part number marked on can; Dunco #181–BBX 100 or equal; Fed Tele & Rad part/dwg #GH–3161–2, spec #GS–1315–2.	2Z7599A–241

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT-66/GRC	RT-67/GRC	RT-68/GRC			
R-107,	R-107,	R-107,	V-102 filament coupling.	RESISTOR, fixed: comp; 10 ohms ±5%; ½ w; JAN type RC20BF100J.	3RC20BF100J
R-148,	R-148,	R-148,	V-108 filament voltage-dropping resistor.		
R-149	R-149	R-149	V-108 filament voltage-dropping resistor.		
R-176	R-176	R-176	V-115 filament voltage-dropping resistor.	RESISTOR, fixed: comp; 12 ohms ±5%; ½ w; JAN type RC20BF120J.	3RC20BF120J
R-124,	R-124,	R-124,	V-104B filament voltage-dropping resistor.	RESISTOR, fixed: comp; 18 ohms ±10%; ½ w; JAN type RC20BF180K.	3RC20BF180K
R-161	R-161	R-161	V-114 filament shunt.		
R-25,	R-25,	R-25,	V-5 filament voltage-dropping resistor.	RESISTOR, fixed: comp; 20 ohms ±5%; ½ w; JAN type RC20BF200J.	3RC20BF200J
R-53	R-53	R-53	V-11 plate decoupling.		
R-123	R-123	R-123	V-106 filament shunt	RESISTOR, fixed: comp; 22 ohms ±10%; ½ w; JAN type RC20BF220K.	3RC20BF220K
R-34,	R-34,	R-34,	V-7 filament shunt.	RESISTOR, fixed: comp; 27 ohms ±5%; ½ w; JAN type RC20BF270J.	3RC20BF270J
R-35	R-35	R-35	V-8 filament shunt.		
R-304	R-304	R-304	E-313 decoupling.	RESISTOR, fixed: comp; 30 ohms ±5%; ½ w; JAN type RC20BF300J.	3RC20BF300J.
R-10	R-10	R-10	V-2 filament voltage-dropping resistor.	RESISTOR, fixed: comp; 33 ohms ±5%; ½ w; JAN type RC20BF330J.	3RC20BF330J
	R-20		V-4 plate dropping	RESISTOR, fixed: comp; 68 ohms ±10%; ½ w; JAN type RC20BF680K.	3RC20BF680K
	R-24,		V-5 plate dropping.	RESISTOR, fixed: comp; 100 ohms ±10%; ½ w; JAN type RC20BF101K.	3RC20BF101K
R-56,			Antenna loading.		
R-177	R-177	R-177	V-102 filament decoupling.		
R-122,	R-122,	R-122,	V-105 filament voltage-dropping resistor.	RESISTOR, fixed: comp; 100 ohms ±10%; 1 w; JAN type RC30BF101K.	3RC30BF101K
R-162	R-162	R-162	V-113 filament shunt.		
R-44,	R-44,	R-44,	V-9 filament shunt.	RESISTOR, fixed: comp; 120 ohms ±10%; ½ w; JAN type RC20BF121K.	3RC20BF121K
R-45	R-45	R-45	V-10 filament shunt.		

R–14, R–20, R–24,	R–14,	R–14,	V–3 filament shunt. V–4 plate dropping. V–5 plate dropping.	RESISTOR, fixed: comp; 150 ohms ±10%; ½ w; JAN type RC20BF151K.	3RC20BF151K
R–102, R–143, R–159	R–102, R–143, R–159	R–102, R–143, R–159	V–101 filament shunt. V–109 filament shunt. V–112 filament shunt.		
R–9	R–9	R–9	V–2 filament shunt	RESISTOR, fixed: comp; 180 ohms ±10%; ½ w; JAN type RC20BF181K.	3RC20BF181K
R–49	R–49	R–49	V–9 and V–10 grid decoupling.	RESISTOR, fixed: comp; 180 ohms ±10%; 1 w; JAN type RC30BF181K.	3RC30BF181K
R–2, R–31, R–43	R–2, R–31, R–43	R–2, R–31, R–43	V–1 cathode bias V–6 plate decoupling. V–7 and V–8 plate decoupling.	RESISTOR, fixed: comp; 220 ohms ±10%; ½ w; JAN type RC20BF221K.	3RC20BF221K
R–18	R–18	R–18	V–4 filament shunt	RESISTOR, fixed: comp; 330 ohms ±10%; ½ w; JAN type RC20BF331K.	3RC20BF331K
R–26, R–36	R–26, R–36	R–26, R–36	V–5 screen decoupling V–8 screen decoupling.	RESISTOR, fixed: comp; 470 ohms ±10%; ½ w; JAN type RC20BF471K.	3RC20BF471K
R–37, R–39	R–37, R–39	R–37, R–39	V–10 voltage divider V–10 voltage divider.	RESISTOR, fixed: comp; 680 ohms ±5%; ½ w; JAN type RC20BF681J.	3RC30BF681J
R–38	R–38	R–38	V–10 voltage divider	RESISTOR, fixed: comp; 820 ohms ±5%; ½ w; JAN type RC20BF821J.	3RC20B821J
R–4, R–12, R–15, R–22, R–50, R–160, R–172	R–4, R–12, R–15, R–22, R–50, R–160 R–172	R–4, R–12, R–15, R–22, R–50, R–160, R–172	V–1 plate decoupling V–3 plate decoupling. V–3 plate decoupling. V–4 plate decoupling. V–11 grid decoupling. V–112 plate decoupling. V–103 plate decoupling.	RESISTOR, fixed: comp; 1000 ohms ±10%; ½ w; JAN type RC20BF102K.	3RC20BF102K
R–306	R–306	R–306	S–301 metering	RESISTOR, fixed: comp; 1200 ohms ±10%; ½ w; JAN type RC20BF122K.	3RC20BF122K
R–108	R–108	R–108	V–102 RETRANS AUDIO output load.	RESISTOR, fixed: comp; 1500 ohms ±10%; ½ w; JAN type RC20BF152K.	3RC20BF152K
R–51			V–11 grid leak	RESISTOR, fixed: comp; 1800 ohms ±10%; 1 w; JAN type RC30BF182K.	3RC30BF182K
R–30	R–30	R–30	V–6 screen decoupling	RESISTOR, fixed: comp; 2200 ohms ±10%; ½ w; JAN type RC20BF222K.	3RC20BF222K
R–40	R–40	R–40	V–9 and V–10 voltage divider.	RESISTOR, fixed: comp; 2700 ohms ±5%; ½ w; JAN type RC20BF272J.	3RC20BF272J
R–52	R–52	R–52	V–11 screen voltage-dropping resistor.	RESISTOR, fixed: comp; 3300 ohms ±10%; 1 w; JAN type RC30BF332K.	3RC30BF332K

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
R–21,	R–21,	R–21,	V–4 screen voltage-dropping resistor.	RESISTOR, fixed: comp; 4700 ohms ±10%; ½ w; JAN type RC20BF472K.	3RC20BF472K
R–119,	R–119,	R–119,	V–105 screen voltage-dropping resistor.		
R–120,	R–120,	R–120,	V–106 screen voltage-dropping resistor.		
R–137	R–137	R–137	V–108 screen voltage-dropping resistor.		
	R–51	R–51	V–11 grid voltage-dropping resistor.	RESISTOR, fixed: comp; 5100 ohms ±5%; 1 w; JAN type RC30BF512J	3RC30BF512J
R–28,	R–28,	R–28,	V–5 filament metering.	RESISTOR, fixed: comp; 6200 ohms ±5%; ½ w; JAN type RC20BF622J	3RC20B5622J
R–47,	R–47,	R–47,	V–9 filament metering.		
R–48	R–48	R–48	V–10 filament metering.		
R–41,	R–41,	R–41,	V–9 and V–10 grid decoupling.	RESISTOR, fixed: comp; 6800 ohms ±10%; ½ w; JAN type RC20BF682K.	3RC20BF682K
R–105,	R–105,	R–105,	V–102 filament metering.		
R–125,	R–125,	R–125,	V–104B filament metering.		
R–142,	R–142,	R–142,	V–109 filament metering.		
R–150	R–150	R–150	V–110 filament metering.		
R–19,	R–19,	R–19,	V–4 filament metering.	RESISTOR, fixed: comp; 7500 ohms ±5%; ½ w; JAN type RC20BF752J.	3RC20BF752J
R–163	R–163	R–163	V–113 and V–114 filament metering.		
R–133,	R–133,	R–133,	V–2 plate voltage-dropping resistor.	RESISTOR, fixed: comp; 8200 ohms ±10%, ½ w; JAN type RC20BF822K.	3RC20BF822K
R–145,	R–145,	R–145,	V–109 screen voltage-dropping resistor.		
R–152,	R–152,	R–152,	V–110 screen voltage-dropping resistor.		
R–156	R–156	R–156	V–111 screen voltage-dropping resistor.		
R–121,	R–121,	R–121,	V–105 filament metering	RESISTOR, fixed: comp; 12,000 ohms ±10%; ½ w; JAN type RC20BF123K.	3RC20BF123K
R–136,	R–136,	R–136,	V–107 screen voltage-dropping resistor.		
R–138,	R–138,	R–138,	V–108 plate voltage-dropping resistor, part of V–109.		
R–178	R–178	R–178	V–115 first audio load.		

R-3, R-117	R-3, R-117	R-3, R-117	V-1 screen voltage divider..... V-105 and V-106 grid bias resistor, part of T-104.	RESISTOR, fixed: comp; 15,000 ohms ±10%; ½ w; JAN type RC20BF153K.	3RC20BF153K
R-42, R-115, R-140, R-147, R-154, R-158	R-42, R-115, R-140, R-147, R-154, R-158	R-42, R-115, R-140, R-147, R-154, R-158	V-10 grid resistor..... V-105 plate load. V-109 decoupling. V-110 grid bias resistor, part of T-110. V-111 grid bias resistor, part of T-111. V-112 grid bias resistor, part of T-112.	RESISTOR, fixed: comp: 18,000 ohms ±10%; ½ w; JAN type RC20BF183K.	3RC20BF183K
R-11, R-32, R-33, R-46	R-11, R-32, R-33, R-46	R-11, R-32, R-33, R-46	V-2 screen dropping..... V-7 grid resistor. V-8 grid resistor. V-10 screen dropping.	RESISTOR, fixed: comp, 22,000 ohms ±10%; ½ w; JAN type RC20BF223K.	3RC20BF223K
R-141	R-141	R-141	V-109 grid resistor.....	RESISTOR, fixed: comp; 27,000 ohms ±10%; ½ w; JAN type RC20BF273K.	3RC20BF273K
R-128	R-128	R-128	V-104B grid resistor.....	RESISTOR, fixed: comp; 33,000 ohms ±10%; ½ w; JAN type RC20BF333K.	3RC20BF333K
R-129	R-129	R-129	V-104B plate voltage-dropping resistor.	RESISTOR, fixed: comp, 36,000 ohms ±5%; ½ w; JAN type RC20BF363J	3RC20BF363J
R-29, R-168	R-29, R-168	R-29, R-168	V-6 screen voltage-dropping resistor. V-133 and V-114 lead circuit balancing.	RESISTOR, fixed: comp; 39,000 ohms ± 10%; ½ w; JAN type RC20BF393K	3RC20BF393K
R-8, R-13, R-17	R-8, R-13. R-17	R-8, R-13, R-17	V-2 grid resistor..... V-3 grid resistor. V-4 grid resistor.	RESISTOR, fixed: comp; 47,000 ohms ± 10%; ½ w; JAN type RC20BF473K	3RC20BF473K
R-131, R-134	R-131, R-134	R-131, R-134	V-2 plate loading, part of T 107 V-107 plate loading, part of T-108.	RESISTOR, fixed: comp; 56,000 ohms ±10%; ½w; JAN type RC20BF563K	3RC20BF563K
R-1, R-7, R-16, R-27, R-54, R-101, R-114	R-1, R-7, R-16, R-27, R-54, R-101, R-114	R-1, R-7, R-16, R-27, R-54, R-101, R-114	V-1 grid resistor..... V-2 grid resistor. V-4 grid resistor. V-6 grid resistor. V-1 grid bias resistor. V-101 grid bias resistor. V-104A grid bias resistor.	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K	3RC20BF104K

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT-66/GRC	RT-67/GRC	RT-68/GRC			
R-6,	R-6,	R-6,	V-2 grid bias resistor	RESISTOR, fixed: comp; 120,000 ohms ±10%; ½ w; JAN type RC20BF124K	3RC20BF124K
R-116,	R-116,	R-116,	V-105 decoupling between discriminator and transmitter reactance.		
R-118,	R-118,	R-118,	V-106 decoupling between discriminator and transmitter reactance.		
	R-301	R-301	V-103 screen voltage-dropping resistor.		
R-174	R-174	R-174	Coupling for squelch oscillator to 1st audio, V-115.	RESISTOR, fixed: comp; 150,000 ohms ±10%; ½w; JAN type RC20BF154K	3RC20BF154K
R-113,	R-113,	R-113,	V-103 grid resistor	RESISTOR, fixed: comp; 180,000 ohms ± 10%; ½ w; JAN type RC20BF184K	3RC20BF184K
R-132,	R 132,	R-132,	V-107 grid resistor, part of T-107.		
R-135,	R-135,	R-135,	V-108 grid resistor, part of T-108.		
R-139,	R-139,	R-139,	V-109 grid resistor.		
R-144,	R-144,	R-144,	V-109 plate loading, part of T-110.		
R-146,	R-146,	R-146,	V-110 grid bias resistor, part of T-110.		
R-151,	R-151,	R-151,	V-110 plate loading, part of T-111.		
R-153,	R-153,	R-153,	V-111 grid bias resistor, part of T 111.		
R-155,	R-155,	R-155,	V-111 plate loading, part of T-112.		
R-157,	R-157,	R-157,	V-112, grid bias resistor, part of T-112.		
R-164,	R-164,	R-164,	V-113 diode load.		
R-165,	R-165,	R-165,	V-114 diode load.		
R-179,	R-179,	R-179,	V-103, grid load.		
R-307	R-307	R-307	Decoupling resistor.		
R-5,	R-5,	R-5	V-2 grid resistor	RESISTOR, fixed: comp; 270,000 ohms ±10%; ½ w; JAN type RC20BF274K	3RC20BF274K
R-109,	R-109,	R-109,	V-103 coupling from squelch oscillator to retransmission audio.		
R-175	R-175	R-175	V-113 coupling output of discriminator to VOLUME control.		
R-169	R-169	R-169	V-114 load circuit balancing	RESISTOR, fixed: comp; 470,000 ohms ±5%; ½ w; JAN type RC20BF474J	3RC20BF474J

R–126, R–127, R–170,	R–126, R–127, R–170,	R–126, R–127, R–170,	V–104B grid resistor. V–104B decoupling. V–113 decoupling from discriminator to transmitter reactance.	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w; JAN type RC20BF474K	3RC20BF474K
R–171	R–171	R–171	V–114 decoupling from discriminator to transmitter reactance.		
R–110, R–167	R–167	R–167	V–103 diode load. V–113 lead circuit balancing.	RESISTOR, fixed: comp; 510,000 ohms ±5%; ½ w; JAN type RC20BF514J	3RC20BF514J
	R–113,	R–113,	V–103 grid resistor.	RESISTOR, fixed: comp; 680,000 ohms ±10%; ½ w; JAN type RC20BF684K	3RC20BF684K
R–173	R–173	R–173	V–113 and V–114 coupling to first audio.		
R–23, R–104,	R–23, R–104,	R–23, R–104,	V–5 grid resistor. V–102 coupling to squelch oscillator.	RESISTOR, fixed: comp; 1 meg ±10%; ½ w; JAN type RC20BF105K	3RC20BF105K
	R–110,	R–110,	V–103 diode load.		
R–111, R–166	R–111, R–166	R–111, R–166	V–103 voltage divider. V–113 and V–114 isolating resistor.		
R–106,	R–106,	R–106,	V–113 coupling from discriminator to retransmission audio.	RESISTOR, fixed: comp; 3.9 meg ±10%; ½ w; JAN type RC20BF395K	3RC20BF395K
	R–55	R–55	V–1 coupling from squelch oscillator to receiver r-f amplifier.		
R–55			V–1 coupling from SQUELCH to receiver r-f amplifier.	RESISTOR, fixed: comp; 2.2 meg ±10%; ½ w; JAN type RC20BF225K	3RC20BF225K
R–130	R–130	R–130	V–106 microphone current limiter.	RESISTOR, fixed: comp; 15 ohms ±10%; 1 w; JAN type RC30BF150K	3RC30BF150K
R–303	R–303	R–303	VOLUME control.	RESISTOR, variable: comp; 500,000 ohms ±20%; 2 w; 70°C max continuous oper temp; 3 solder lugs; metal case 1 1/16″ diam x 2 1/32″ d, encl; double flatted metal shaft ¼″ diam x 2 3/32″ lg w/axially tapped #6–32 hole ¼″ d in end; AB type #A taper, 1% resistance at 30% rotation, 5% at 40%, 10% at 50%, 20% at 60%; 40% at 70%; 65% at 80%, 92% at 90%; insul cont arm; w/o off position; normal torque; 3/32″ lg x 3/8″–32 bushing; nonturn device on 1 1/32″ rad at 9 o'clock; tropicalized and salt water resistant, wp seal in bushing and mtg collar; AB type #JW, modified; Fed Tele & Rad part/dwg #GII–1627–2.	3Z7498–50.142

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
R–103	R–103	R–103	V–102 grid coupling to squelch oscillator.	RESISTOR, variable: comp; 500,000 ohms ±20%; 2 w; 70°C max continuous oper temp; 3 solder lugs; metal case 1 1/16″ diam x 9/16″ d, encl; round metal shaft w/sedr slot, 1/4″ diam x 3/8″ lg; AB type #A taper, 1% resistance at 30% rotation, 5% at 40%, 10% at 50%; 20% at 60%; 40% at 70%; 65% at 80%, 92% at 90%; ins cont arm w/o off position; normal torque, w/shaft locking device; 1/2″ lg x 3/8″–32 bushing, nonturn device on 17/32″ rad at 9 o'clock; tropicalized and salt water resistant; AB type #SD–40406; Fed Tele & Rad part/dwg #GH–1565–2.	3Z7498–50.122
R–302	R–302	R–302	SQUELCH control	RESISTOR, variable: comp; 2 sect; ea sect 500,000 ohms ±20%; ea sect 2 w, 70 deg max continuous oper temp; 3 solder lugs ea sect; metal case 1 1/16″ diam x 1 3/8″ lg, encl; round metal shaft w/double flats on end, shaft 1/4″ diam x 23/32″ lg w/axially tapped #6–32 hole 1/4″ d in end; front sect AB type #S taper, 4% resistance at 20% rotation, 15% at 30%, 33% at 40%, 50% at 50%, 70% at 60%; 90% at 70%, 98% at 90% rear sect, extreme counterclockwise position 1% of total resistance, 455,000 ohms ±20% at 50% rotation, 10,000 ohms at extreme clockwise position; ins cont arms, w/o off position; normal torque; 9/32″ lg x 3/8″–32 bushing, nonturn device on 17/32″ lg x 3/8″–32 bushing, nonturn device on 17/32″ rad at 9 o'clock; SPST switch, normally open, oper at start or rotation, 2 amp, 125v, 2 solder lug term; tropicalized and salt water resistant, wp seal in bushing and mtg collar; AB type #JJSW, modified; Fed Tele & Rad part/dwg #GH–16492.	3Z498–50.143
O–321, O–322	O–321, O–322	O–321, O–322	Dial drive shaft waterproof seal Dial drive shaft waterproof seal	SEAL, water: Buna N; circular w/circular cross section; 5/8″ OD x 7/16″ ID x 3/32″ thk; Linear Inc part #1820–9; Fed Tele & Rad part/dwg #GS–1948–1–8.	6Z8093–13
H–401 through H–404	H–401 through H–404	H–401 through H–404	Back plate chassis mounting screws.	SCREW, captive: slot drive; cheese head, finished .312″ diam ±.005″, 1/32″ x 45 deg chamfer, head 1 15/16″ lg; cad pl and green iridited steel; #10–32 NF–2; 2 1/2″ lg; thd portion 3/8″ lg; head .312″ diam x 1 15/16″ lg; slotted groove ground head portion .043″ wd x .031″ d, 1 1/16″ from bottom edge of head, cone points; p/o Fed Tele & Rad #GA–1498–12 and #GA–1698–12 back pl assem; Fed Tele & Rad part/dwg #GB–1493–2.	6L4770–40.86C
H–313, H–314	H–313, H–314	H–313, H–314	Retainer plate mounting screws	SCREW, captive: slot drive; round head finished per dwg; steel, cad pl and olive drab iridited; #6–32 NC–2; 5/8″ lg; thd for 3/16″ of lg; head .260″ max diam x .103″ max thk, slot .045″ wd x .067″ d max; p/o Fed Tele & Rad #GA–2632–12 cover sub assem; Fed Tele & Rad part/dwg #GB–2635–2.	6L4766–10.49S
H–405 through H–408	H–405 through H–408	H–405 through H–408	Chassis-to-panel mounting screws.	SCREW, machine: slot drive; hex head, unfinished; steel, cad pl and green iridited; #10–32 NF–2; 7/8″ lg; thd entire lg; slot in head .047″ wd x .062″ d; Fed Tele & Rad part/dwg #GB–2439–2.	6L7032–14.81CS

H–1, H–2	H–1, H–2	H–1, H–2	Crystal switch shaft assembly mounting screws.	SCREW, machine: slot drive; hex head, unfinished; steel, cad pl and olive drab iridited; #6–32 NC–2; ¼″ lg; thd entire lg; head ¼″ across flats x 7/64″ thk, slot 1/32″ wd x 1/16″ d; p/o Fed Tele & Rad #GA–1515–12 parts 1, 2, and 3 switch assem; Fed Tele & Rad part/dwg #GB–2301–2.	6L6632–4.81CS
O–305	O–305	O–305	Variable cam adjusting plunger shaft.	SHAFT: p/o Fed Tele & Rad #GA–1593–14 panel assem; c/o 1 Fed Tele & Rad #GB–1561–2 plunger and 1 #GB–1563–2 key; SS, passiviated; mts in 7/16″ hole in panel; key end has axial hex hole .197″ across flats, 3/8″ d, key held to plunger w/piece of wire until assem in equipment, scdr slot in headed portion of plunger and shoulder .403″ x .093″ thk, .2195″ down from slotted end; Fed Tele & Rad part/dwg #GA–2446–2.	2Z8204–178
O–103	O–103	O–103	Coupling shaft	SHAFT: coupling shaft; brass rod, acid dip finish; .25″ diam x 1 5/8″ lg; mts 2Z8204–176 in ¼″ diam clearance hole; both ends chamfered 1/64″ x 45 deg; Fed Tele & Rad part/dwg #GB–2571–2.	
O–6	O–6	O–6	Coupling shaft	SHAFT: coupling shaft; p/o Fed Tele & Rad #GA–1672–14 RF chassis assem; SS rod; .187″ diam x 5 1/8″ lg, both ends chamfered 1/32″ x 1/32″; mts in .189″ diam hole in coupling; Fed Tele & Rad part/dwg #GB–2541–2.	2Z8204–177
O–306	O–306	O–306	Receiver antenna tuning adjusting shaft.	SHAFT ASSEMBLY: flexible; p/o Fed Tele & Rad #GA–1593–14 panel assem; c/o 1 Fed Tele & Rad #GB–1402–2–1 flexible shaft w/1 #GB–2530–2 fitting soldered on 1 end, and 1 #GB–2808–2 fitting soldered on other end; phosphor bronze shaft and SS fittings; .468″ diam x 3 25/32″ lg o/a; mts thru hole in panel by means of headed fitting .248″ diam, other end fitting .188″ diam mts in coupling hole; headed fitting has scdr slot; Fed Tele & Rad part/dwg #GA–1400–2–GR I.	2Z8201.69
O–307	O–307	O–307	Transmitter antenna coupling adjusting shaft.	SHAFT ASSEMBLY: flexible; p/o Fed Tele & Rad #GA–1593–14 panel assem; c/o 1 Fed Tele & Rad #GB–1402–2–2 flexible shaft w/1 #GB–1403–2 fitting soldered on 1 end and 1 #GB–1401–2 fitting soldered on other end; phosphor bronze shaft and SS fittings; .468″ diam x 6 1/16″ lg o/a; mts thru hole in panel by means of headed fitting .248″ diam, other end fitting .188″ diam mts in coupling hole; headed; fitting has scdr slot; Fed Tele & Rad part/dwg #GA–1400–2–GR II.	2Z8201.70
E–1	E–1	E–1	Tube shield	SHIELD, tube: JAN type SOS3; cad pl brass; round w/hole in top; bayonet push-on mtg; .81″ ID x 1 3/4″ lg; pressure coil spring inside; spec JAN–S–28.	2Z8304.57
E–2 through E–10, E–101 through E–116	E–2 through E–10, E–101 through E–116	E–2 through E–10, E–101 through E–116	Tube shields	SHIELD, tube: JAN type SOS6; cad pl brass; round w/hole in top; bayonet push-on mtg; .81″ ID x 1¾″ lg; pressure coil spring inside; spec JAN–S–28.	2Z8304.154

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT-66/GRC	RT-67/GRC	RT-68/GRC			
O-308	O-308	O-308	Fexible shaft spacer	SLEEVE, spacer: p/o Fed Tele & Rad #GA-1593-14 panel assem; brass bright dip finish; tubular; .312″ OD x .25″ ID x .234″ lg; mts on shaft by ctr hole; Fed Tele & Rad part/dwg #GB-2454-2.	2Z8552-65
J-3	J-3	J-3	Provides test points for the final stages of transmitter.	SOCKET. crystal: 4 round female cont; Cinch #9804	2Z8678
		X-21,	Crystal sockets	SOCKET, crystal: ceramic body; tropicalized; 2 round female silver pl phosphor bronze cont; rectangular w/round ends; $\frac{55}{64}$″ lg x $\frac{3}{8}$″ wd x $\frac{43}{64}$″ h o/a; cont on .480″ ctr; one $\frac{1}{8}$″ diam mtg hole ctr between cont; Fed Tele & Rad part/dwg #GH-1901-2.	2Z8672.80
X-22,	X-22,	X-22,			
X-23,	X-23,	X-23,			
	X-24,	X-24,			
X-25,	X-25,	X-25,			
	X-26,	X-26,			
X-27,	X-27	X-27,			
	X-28,	X-28,			
X-29		X-29,			
	X-30,	X-30,			
X-31,	X-31,	X-31,			
	X-32,	X-32,			
X-33,	X-33,	X-33,			
X-34	X-34	X-34,			
		X-35			
		X-36			
		X-37			
X-101,	X-101,	X-101,	Tube socket, V-101	SOCKET, tube: 7 cont miniature; JAN type S010M; 1 piece saddle mtg; two $\frac{1}{8}$″ diam mtg holes on $\frac{7}{8}$″ mtg/c; round plastic body w/metal shell, $1\frac{1}{8}$″ lg x .8″ wd x $\frac{25}{32}$″ d excluding term; beryllium copper silver pl cont; marked S010M; w/metal shock shield and ctr shield .18″ OD; spec JAN-S-28.	2Z8677.94
X-102,	X-102,	X-102,	Tube socket, V-102.		
X-103,	X-103,	X-103,	Tube socket, V-103.		
X-104,	X-104,	X-104,	Tube socket, V-104.		
X-105,	X-105,	X-105,	Tube socket, V-105.		
X-106,	X-106,	X-106,	Tube socket, V-106.		
X-107,	X-107,	X-107,	Tube socket, V-107.		
X-108,	X-108,	X-108,	Tube socket, V-108.		
X-109,	X-109,	X-109,	Tube socket, V-109.		
X-110,	X-110,	X-110,	Tube socket, V-110.		
X-111,	X-111,	X-111,	Tube socket, V-111.		
X-112,	X-112,	X-112,	Tube socket, V-112.		
X-113,	X-113,	X-113,	Tube socket, V-113.		
X-114,	X-114,	X-114,	Tube socket, V-114.		
X-115	X-115,	X-115,	Tube socket, V-115.		
X-116,	X-116,	X-116,	Tube socket, V-116.		
X-1,	X-1,	X-1,	Tube socket, V-1	SOCKET, tube: 7 cont miniature; JAN type S010C; 1 piece saddle mtg; two $\frac{1}{8}$″ diam mtg holes on $\frac{7}{8}$″ mtg/c; round ceramic body w-metal shell;	2Z8677.99
X-2,	X-2,	X-2,	Tube socket, V-2.		

X–3, X–4, X–5, X–6, X–7, X–8, X–9, X–10	X–3, X–4, X–5, X–6, X–7, X–8, X–9, X–10	X–3, X–4, X–5, X–6, X–7, X–8, X–9, X–10	Tube socket, V–3. Tube socket, V–4. Tube socket, V–5 Tube socket, V–6. Tube socket, V–7. Tube socket, V–8. Tube socket, V–9. Tube socket, V–10.	1⅛″ lg x .8″ wd x $^{25}/_{32}$″ d excluding term; beryllium copper silver pl cont; marked S010C; w/metal shock shield and ctr shield .18″ OD; spec JAN–S–28.	
X–200	X–200	X–200	Test points	SOCKET, tube: octal; 1 piece molded in mtg pl; two $^{5}/_{32}$″ diam mtg holes on 1½″ mtg/c; round plastic body 1.11″ diam x 40″ h excluding term; beryllium copper silver pl cont; Amphenol #50–103; Fed Tele & Rad part/dwg #GH–2039–2.	2Z8678.338
X–11	X–11	X–11	Tube socket, V–11	SOCKET, tube: octal; 1 piece saddle mtg; two .156″ diam mtg holes on 1½″ mtg/c; round ceramic body 1.156″ diam x $^{23}/_{64}$″ h excluding term; silver pl phosphor bronze cont; Natl. Co. #C1R–8; Fed Tele & Rad part/dwg #GH–2627–2; U. S. Army spec #71–3074.	2Z8678.53
O–309	O–309	O–309	Plunger shaft return spring	SPRING: helical compression type; .031″ diam SS spring wire; .327″ OD x 1″ lg; 8 turns; squared ends, ground; p/o Fed Tele & Rad #GA–1593–14 panel assem; Fed Tele & Rad part/dwg #GB–1562–2.	2Z8877.357
O–401 through O–404	O–401 through O–404	O–401 through O–404	Back plate mounting screw release springs.	SPRING: helical compression type; provides spring tension on mtg screw; .025″ cad pl olive drab iridited music wire; 1⅛″ lg x .381″ OD o/a; 10 turns; squared ends, ground; heat treated to remove hydrogen embrittlement; p/o Fed Tele & Rad #GA–1698–12 and #GA–1486–12 back plate assem; Fed Tele & Rad part/dwg #GB–1492–2.	2Z8877.356
O–7	O–7	O–7	Gear assembly return spring	SPRING: helical extension type; .02″ diam spring temper SS wire; .766″ lg x .21″ OD o/a; 22 turns; parallel eye term .141″ ID on ⅝″ ctr; p/o Fed Tele & Rad #GA–1897–12 condenser assem; Fed Tele & Rad part/dwg #GB–1887–2.	2Z8877.353
O–405 through O–412	O–405 through O–412	O–405 through O–412	Panel to case catch fastener strikes.	SPRING: loop type; strike for Dzus fastener; .08″ diam, olive drab iridited music wire; 1⅜″ lg x $^{5}/_{32}$″ wd x .08″ thk o/a; 2 ends turned perpendicular at 90 deg angle to straight portion on 1/16″ rad; Dzus dwg #X–487; Fed Tele & Rad part/dwg #GB–2414–2.	6Z8377–10
O–8, O–9, O–10, O–12	O–8, O–9, O–10, O–12	O–8, O 9, O–10, O–12	Adjustable tuning core tension springs.	SPRING: loop type; .033″ diam cad pl and olive drab iridited music wire; $^{25}/_{64}$″ lg x ¼″ wd x .037″ thk o/a; irregular shaped snap on type spring, snaps on stud and screw assem and exerts pressure on screw thd; p/o Fed Tele & Rad #GA–1671–14 RF coil box assem; Fed Tele & Rad part/dwg #GB–2007–2.	2Z8877.358

Ref symbol RT-66/GRC	Ref symbol RT-67/GRC	Ref symbol RT-68/GRC	Function of part	Name of part and description	Signal Corps stock No.
S-301	S-301	S-301	METER selector	SWITCH, rotary: 1 pole 12 position; single sect; spring silver cont; plastic body; 1 9/16" lg x 1 1/4" wd x 9/16" d excluding term; nonshorting cont; locking action; solder lug term; bushing 3/8"-32 x 5/16" lg, shaft 1/4" diam x 11/16" lg from mtg surface, double flatted end and axially tapped hole #6-32 x 1/4" d in end, flush mtd; wp seal in mtg bushing and collar; Fed Tele & Rad part/dwg #GH-1414-2.	3Z9825-92.3
S-1	S-1	S-1	Crystal	SWITCH, rotary: 1 pole, 18 position; single sect; silver zinc alloy cont; plastic body; 1.718" diam x 3/4" lg o/a; cont; nonlocking wiper action; solder lug term; single hole mtg, bushing 3/8"-32 x 1/2" lg; shaft 1/4" diam x 1" lg from mtg surface; supplied w/lockwasher and hex nut; Fed Tele & Rad part/dwg #GH-1423-2.	3Z9825-92.2
S-302	S-302	S-302	DIAL LIGHT—OFF-ON-RING switch.	SWITCH, rotary: 5 pole, 3 position; single sect; spring silver cont; plastic body; 1 9/16" lg x 1 1/4" wd x 9/16" d excluding term; nonshorting cont; locking in clockwise position, spring loaded return from counterclockwise to ctr position; solder lug term; single hole mtg, bushing 3/8"-32 x 5/16" lg, shaft 1/4" diam x 11/16" lg from mtg surface has double flatted end and has axially tapped hole #6-32 x 1/4" d in end; wp seal in mtg bushing and collar; Fed Tele & Rad part/dwg #GH-1348-2.	3Z9825-92.4
E-66 through E-73, E-157 through E-174	E-66 through E-73, E-157 through E-174	E-66 through E-73, E-157 through E-174	Grounding terminal lugs.	TERMINAL, lug: straight type w/2 bent-up soldering ears; brass, hot tin dipped; 27/64" lg x 7/32" wd x 3/32" h o/a; .12" diam mtg hole between ears, ears bent up at 45 deg angle; solder connects to wire, wrap-around type w/1/32" rad slots in either side of ears; p/o Fed Tele & Rad #GA-2106-14 chassis riveting assem; Fed Tele & Rad part/dwg #GB-2248-2-1.	3Z12073-57
T-115	T-115	T-115	Output transformer	TRANSFORMER, AF: plate coupling type; pri 19,000 ohms impedance CT, .005 amp DC; secd 600 ohms impedance CT, 500 v RMS test; HS steel case, sillicon steel core; 1 3/16" sq x 2 1/2" h o/a; turns ratio of pr to secd 5.54:1; freq response 250-2500 cyc, +2 db to -2 db; 6 solder type stud term on bottom of case; two #6-32 x 15/64" lg mtg studs on diagonally opposite corners on 1 3/16 x 1 3/16" mtg/c; part number marked on top of case; Fed Tele & Rad part/dwg #GH-1202-2; spec JAN-T-27.	2Z9632.585
T-102, T-114	T-102, T-114	T-102, T-114	Retransmission audio coupling to B Of J-312. Interstage coupling of first audio to power audio.	TRANSFORMER, AF: plate coupling type; pri 22,000 ohms impedance CT, .006 amp DC; secd #1,600 ohms impedance CT secd #2,5200 ohms impedance CT, 500 v RMS test HS steel case, silicon steel core; 1 3/8" lg x 7/8" wd x 2 1/16" h o/a; 160 mw output; turns ratio pri to secd #1,6.28:1; pri to secd #2 2.03:1; freq response +2 db to -2 db between 250 and 2500 cyc; 9 solder type stud term on bottom of case; two .128" diam mtg holes on 1 1/8" mtg/c; part number marked on top of case; Fed Tele & Rad part/dwg #GH-1203-2.	2Z9632.562

T–105	T–105	T–105	1,600-cycle oscillator.	TRANSFORMER, AF plate coupling type; designed so that tank wnd term 3 and 4 tunes to 1600 cyc ±5 cyc w/.036 uf in shunt w/Q greater than 25 and .015 amp DC in wnd, feedback wnd term 1 and 2, to deliver 50 v to 1 meg and grid, output wnd term 5 and 6, to deliver 2.2 v to 2400 ohms, 500 v RMS test; HS steel case, molypermalloy core; 1⅜″ lg x ⅞″ wd x 2 1/16″ h o/a; turns ratio tank to output wnd 5.73:1, feedback to output wnd 17.87:1; 6 solder type stud term on bottom of case; two .128″ diam mtg holes on 1⅛″ mtg/c; part number marked on top of case; Fed Tele & Rad part/dwg #GH–1204–2.	2Z9632.584
T–106	T–106	T–106	Microphone coupling to 1,600-cps oscillator V–104B.	TRANSFORMER, AF: input type; pri #1, 30 ohms impedance; pri #2 190 ohms impedance; secd 19,000 ohms impedance CT, 500 v RMS test; HS steel case, silicone steel core; 1⅜″ lg x ⅞″ wd x 2 1/16″ h o/a; turns ratio pri #1 to secd 1:22.8; pri #2 to secd 1:10; freq response 250–2500 cyc; +2 db to −2 db; 7 solder type stud term on bottom of case; two .128″ diam mtg holes on 1⅛″ mtg/c; part number marked on top of case; Fed Tele & Rad part/dwg #GH–1205–2.	2Z9631.393
T–107	T–107	T–107	First mixer (receiver) grid mixer.	TRANSFORMER, IF: 5 mc; input; shielded; 1 17/32″ lg x 1 9/32″ wd x 2 17/32″ h o/a; powdered iron core; single tuned; adj iron core tuning; two #6–32 x 9/32″ lg mtg studs on diagonally opposite corners of base on .859″ x .609″ mtg/c; 6 solder type term, 1 of which is dummy; tropicalized; Muter #C–7320–1; Fed Tele & Rad part/dwg #GH–2343–12–1.	2Z9643.352
T–108	T–108	T–108	First and second variable i-f interstage tuning unit.	TRANSFORMER, IF: 5 mc; inter-stage; shielded 1 17/32″ lg x 1 9/32″ wd x 2 17/32″ h o/a; powdered iron core; single tuned; adj iron core tuning; two #6–32 x 9/32″ lg mtg studs on diagonally opposite corners of base on .859″ x .609″ mtg/c; 6 solder type term, 1 of which is dummy; tropicalized; Muter #C–7320–2; Fed Tele & Rad part/dwg #GH–2343–12–2.	2Z9643.353
T–109	T–109	T–109	Second variable i-f and second receiver mixer interstage tuning unit.	TRANSFORMER, IF: 5 mc; interstage; shielded; 3 3/16″ lg x 1 1/16″ wd x 2 19/32″ h o/a; powdered iron cores; ea unit single tuned; adj iron core tuning; two .169″ diam mtg holes on 2⅞″ mtg/c; 5 wire leads; tropicalized; c/o 2 shielded IF transformers interwired and mtd on common base plate; Muter #C–7322; Fed Tele & Rad part/dwg #GH–1937–12.	2Z9643.355
T–110, T–111, T–112	T–110, T–111, T–112	T–110, T–111, T–112	Mixer to first i-f coupling. First i-f to first limiter coupling. First to second limiter coupling.	TRANFORMER, IF:1.4 mc;interstage; shielded;1 17/32″ lg x 1 9/32″ wd x 2 17/32″ h o/a; powdered iron core; pri and secd tuned; adj iron core tuning; two #6–32 x 9/32″ lg mtg stud on diagonally opposite corners of base on .859″ x .609″ mtg/c; 6 solder type term; tropicalized; Muter #C–7318; Fed Tele & Rad part/dwg #GH–2342–12–1.	2Z9642.126
T–113	T–113	T–113	Discriminator tuning unit.	TRANSFORMER, IF: 1.4 mc; discriminator; shielded; 1 17/32″ lg x 3 1/32″ wd x 2 17/32″ h o/a; powdered iron core; pri and secd tuned; adj iron core tuning; two #6–32 x 9/32″ lg mtg studs on diagonally opposite corners of base on .859″ x .609″ mtg/c; 6 solder type term, 1 of which is dummy; tropicalized; Muter #C–7321; Fed Tele & Rad part/dwg #GH–2345–12.	2Z9643.354

Ref symbol RT-66/GRC	Ref symbol RT-67/GRC	Ref symbol RT-68/GRC	Function of part	Name of part and description	Signal Corps stock No.
V-113, V-114	V-113, V-114	V-113, V-114	Discriminators	TUBE, electron: JAN-1A3; diode	2J1A3
V-7, V-8	V-7, V-8	V-7, V-8	Transmitter r-f amplifiers	TUBE, electron: JAN-1AE4; pentode; per Fed Tele & Rad spec/dwg #GH-1123-2.	2J1AE4
V-101,	V-101,	V-101,	Receiver oscillator	TUBE, electron: JAN-1L4; pentode	2J1L4
V-110,			First fixed i.f.		
V-112	V-112	V-112	Second limiter.		
V-2,	V-2,	V-2,	First receiver mixer	TUBE, electron: JAN-1R5; pentagrid converter	2J1R5
V-105,	V-105,	V-105,	Transmitter reactance.		
V-106,	V-106,	V-106,	Transmitter reactance.		
V-109	V-109	V-109	Second receiver mixer.		
V-103	V-103	V-103	Squelch oscillator	TUBE, electron: JAN-1S5; diode-pentode	2J1S5
V-107,	V-107,	V-107,	First variable i.f.	TUBE, electron: JAN-1U4; pentode	2J1U4
V-108,	V-108,	V-108	Second variable i.f.		
	V-110,	V-110,	First fixed i.f.		
V-111	V-111	V-111	First limiter.		
V-11	V-11	V-11	Transmitter power amplifier	TUBE electron: JAN-2E24; pentode	2J2E24
V-6	V-6	V-6	Transmitter mixer	TUBE electron: JAN-3A4; power amplr, pentode	2J3A4
V-3,	V-3,	V-3,	Crystal oscillator harmonic generator.	TUBE, electron: JAN-3A5; twin triode	2J3A5
V-104,	V-104,	V-104,	One-half transmitter oscillator; half modulated continuous waves oscillator.		
V-116	V-116	V-116	Power audio.		
V-9,	V-9,	V-9,	Transmitter driver	TUBE, electron: JAN-3B4; pentode	2J3B4
V-10	V-10	V-10	Transmitter driver.		
V-4,	V-4,	V-4,	First harmonic amplifier	TUBE, electron: JAN-3Q4; power amplr. pentode	2J3Q4
V-5	V-5	V-5	Second harmonic amplifier.		
V-102,	V-102,	V-102,	Retransmission audio amplifier.		
V-115	V-115	V-115	First audio amplifier.		
V-1	V-1	V-1	First r-f amplifier, receiver	TUBE, electron: JAN-6AK5; pentode	2J6AK5

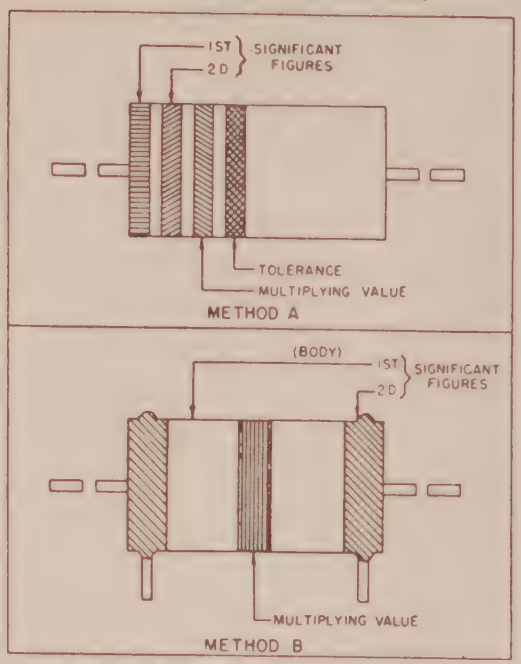
H-317	H-317	H-317	Binding post insulator	WASHER, extruded: molded plastic; round, 5/8" OD x .1405" ID x 13/64" thk o/a; extrusion .312" OD x .078" h; face ctb .300" diam x .046" d; p/o Fed Tele & Rad #GA-1593-14 panel assem; Fed Tele & Rad part/dwg #GG-1514-2.	6L52630
H-315	H-315	H-315	Binding post insulating mounting washer.	WASHER, flat: LTS-E-4 natural phenolic; 5/8" OD x .154" ID x 1/16" thk; p/o Fed Tele & Rad #GA-1593-14 panel assem; Fed Tele & Rad part/dwg #GG-2542-2.	6L52010-1
H-3	H-3	H-3	Segment gear spacing washer.	WASHER, flat: brass, acid dip finish; 3/8" OD x .19" ID x .04" thk; p/o Fed Tele & Rad #GA-1897-12 capacitor assem; Fed Tele & Rad part/dwg #GB-1888-2.	6L50100-2
H-4 through H 9	H-4 through H-9	H-4 through H 9	Insulating washers	WASHER, flat: LTS-E-5 natural phenolic; 3/8" OD x .169" ID x 1/32" thk; p/o Fed Tele & Rad #GA-1671-14 RF coil box assem. and #GA-1672-14 RF chassis assem; Fed Tele & Rad part/dwg #GP-1903-2.	6L52002-1
H-101, H 102	H-101, H-102	H 101, H-102	Toroid coil insulating mounting washers.	WASHER, flat: LTS-E-5 natural phenolic; round, 13/16" OD x .17" ID x 1/16" thk; Fed Tele & Rad part/dwg #GP-3092-2.	6L52000-1
H-316	H-316	H 316	Dog washer—rotation stop	WASHER, flat: steel, cad pl; round, 9/16" OD x .315" ID x .120" thk o/a including dog; dog on outer edge .109" wd x .12" h, material of washer .062" thk; Oak catalog #2394; Fed Tele & Rad part/dwg #GB-2453-2.	6L58425
H-10, through H-15, H-16, H-17	H-10, through H-15, H-16, H-17	H 10. through H 15, H 16, H 17, H 18, H 19, H-20	Trimmer capacitor mountings. Insulating mounting washers.	WASHER, flat: LTS-E-5 natural phenolic; 15/64" OD x .116" ID x .025 thk; p/o Fed Tele & Rad #GA-2457-2 and #GA-2458-2 board assem; Fed Tele & Rad part/dwg #GP 2383-2.	6L52001-1
				MISCELLANEOUS PARTS	
H-409	H-409	H-409	Tube puller	PULLER, tube: basket type; steel wire w/flattened copper tubing finger grip, galv; approx 2 1/2" lg, basket portion approx 5/8" OD, finger grip portion 1" wd x 1/4" thk; for removing miniature tubes; Kellems #11-16; Fed Tele & Rad part/dwg #GB-3037-2.	6R7443-4
H-410	H-410	H-410	Set screw wrench	WRENCH: set screw key; .05" across flats; short arm 21/32" lg, long arm 1 27/32" lg; steel, parkerized; L shaped hex bar; for Allen #4 set screw and #1 FH cap screw; Allen Mfg code #050	6R55499.3
H-411	H-411	H-411	Set screw wrench	WRENCH: set screw key; 1/16" across flats; short arm 21/32" lg, long arm 1 27/32" lg; steel, parkerized; L shaped hex bar; for Allen #5 and #6 set screw, and #4 FH cap screw; Allen Mfg code #116.	6R577400-6

Ref symbol			Function of part	Name of part and description	Signal Corps stock No.
RT–66/GRC	RT–67/GRC	RT–68/GRC			
H–412	H–412	H–412	Set screw wrench	WRENCH: set screw key; 7/64" across flats; short arm 9/64" lg, long arm 1 31/32" lg; steel, parkerized; L shaped hex bar; for Allen #8 set screw, #4 socket head cap screw and #6 FH cap screw; Allen Mfg code #564.	6R57400
H–413	H–413	H–413	Set screw wrench	WRENCH: set screw key, 3/32" across flats, short arm 3/4" lg, long arm 2 3/32" lg; steel, parkerized; L shaped hex bar; for Allen #10 set screw, #5 and #6 socket head cap screws, and #8 FH cap screw· Allen Mfg code #332.	6R57433
E–307, E–308	E–307, E–308	E–307, E–308	Tuning knob (MCS). Tuning knob (TENTH MCS).	KNOB ASSEMBLY round w extended bar; aluminum, olive drab enamel finish; mts on 7/16" diam double flatted hub; mts to shaft by single #10–32 NF–2 thd screw mtd axially thru ctr of knob; 3 1/2" lg x 2 5/16" wd x 1 11/16" h o/a; shaft hole 9/32" d; c/o 1 Fed Tele & Rad #GC–3074–12 knob, #GB–3077–2 screw, 1 #GB–3076–12 upper ratchet plate, 2 #GB–3075–12 stop arms, 1 #GA–3078–2 hub assem, and misc hardware; Fed Tele & Rad part/dwg #GA–3073–2.	2Z5816.29
E–326, E–327	E–326, E–327	E(326, E–327	Stop adjusting knobs	KNOB: round; naval brass, olive drab enamel finish; for 1/4" diam shaft; fastens to shaft by means of spring; washers and retaining ring not supplied as part of knob; unmarked; 3/4" OD x 9/16" h o/a; shaft hole extends thru knob; three .098" diam x 1/8" d axial holes in bottom face on .281" rad, 90 deg apart, stop pin in bottom face Fed Tele & Rad part/dwg #GA–3068–2.	2Z5822–441
O–327, O–328	O–327, O–328	O–327, O–328	Knob tension springs	SPRING: helical compression type; .031" diam SS spring temper wire passivated; 3/8" lg x .327" OD x .265" ID; 5 turns; closed ends; Fed Tele & Rad part/dwg #GB—3072–2.	2Z8877.354
O–329, O–330	O–329, O–330	O–329, O–330	Dial drive shaft waterproof seal retainers.	RING, retainer; tuning shaft "O" ring seal retainer; aluminum, caustic etch finish; round; .875" OD x .439" ID x .189" thk; mts on shaft by means of ctr hole; upper outside edge chamfered; hole beveled 90 deg between faces from .439" diam at bottom to .745" diam at top; Fed Tele & Rad part/dwg #GB–3031–2.	2Z7858–143
O–331, O–332	O–331, O–332	O–331, O–332	Stop arm and knob mounting hubs.	HUB: SS passivated; round disc w/double flatted hollow round shaft extending from 1 side; 1 9/16" OD x .873" h, ID is double flatted hole .439" lg x .314" wd; mts by ctr hole; upper surface of disc portion has 120 equally spaced teeth; Fed Tele & Rad part/dwg #GA–3078–2.	2Z5180–28
H–328, H–329	H–328, H–329	H–328, H–329	Knob mounting studs	STUD: c/o 1 Fed Tele & Rad #GB–3128–2 disc, 1 #GB–3130–2 pin, and 1 #GB 3129–2 stud; SS, passivated and olive drab finish; round disc w stud extending from 1 side; approx 7/8" diam x 1" h o/a; two .128" diam csk mtg holes in disc portion on .594" mtg/c; groove for retainer ring near end of stud, stop pin in disc; Fed Tele & Rad part/dwg #GA–3067–12.	2Z8634–13

O–333 O–334	O–333 O–334	O–333 O–334	Arm stop springs.	SPRING: flat type; .032″ thk spring temper phosphor bronze; $\frac{3}{4}$″ lg x .189″ wd x $\frac{3}{8}$″ h o/a; U shaped w/offset ends (L shaped); Fed Tele & Rad part/dwg #GB–3069–2.	2Z8877.355
E–74	E–74	E–74	Connector contact shorting bar.	BAR, shorting: .063″ diam spring steel wire; U shaped; approx $1\frac{11}{16}$″ lg x .281″ wd x .093″ thk o/a; mts in female connector cont by means of leg portions; top finger grip portion coated w/black polyamide resin; flat in ea leg $\frac{1}{4}$″ down from base portion; hardened to Rockwell #C–40 to C–45; Fed Tele & Rad part/dwg #GA–3106–2.	2Z588–46

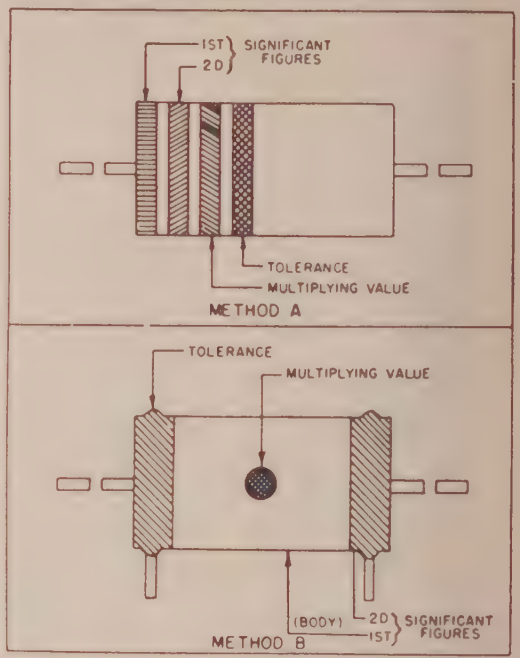
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS*



A

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS*



B

COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± –
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	–	0.1	± 5
SILVER	–	0.01	± 10
NO COLOR	–	–	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR. NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND.

* RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED

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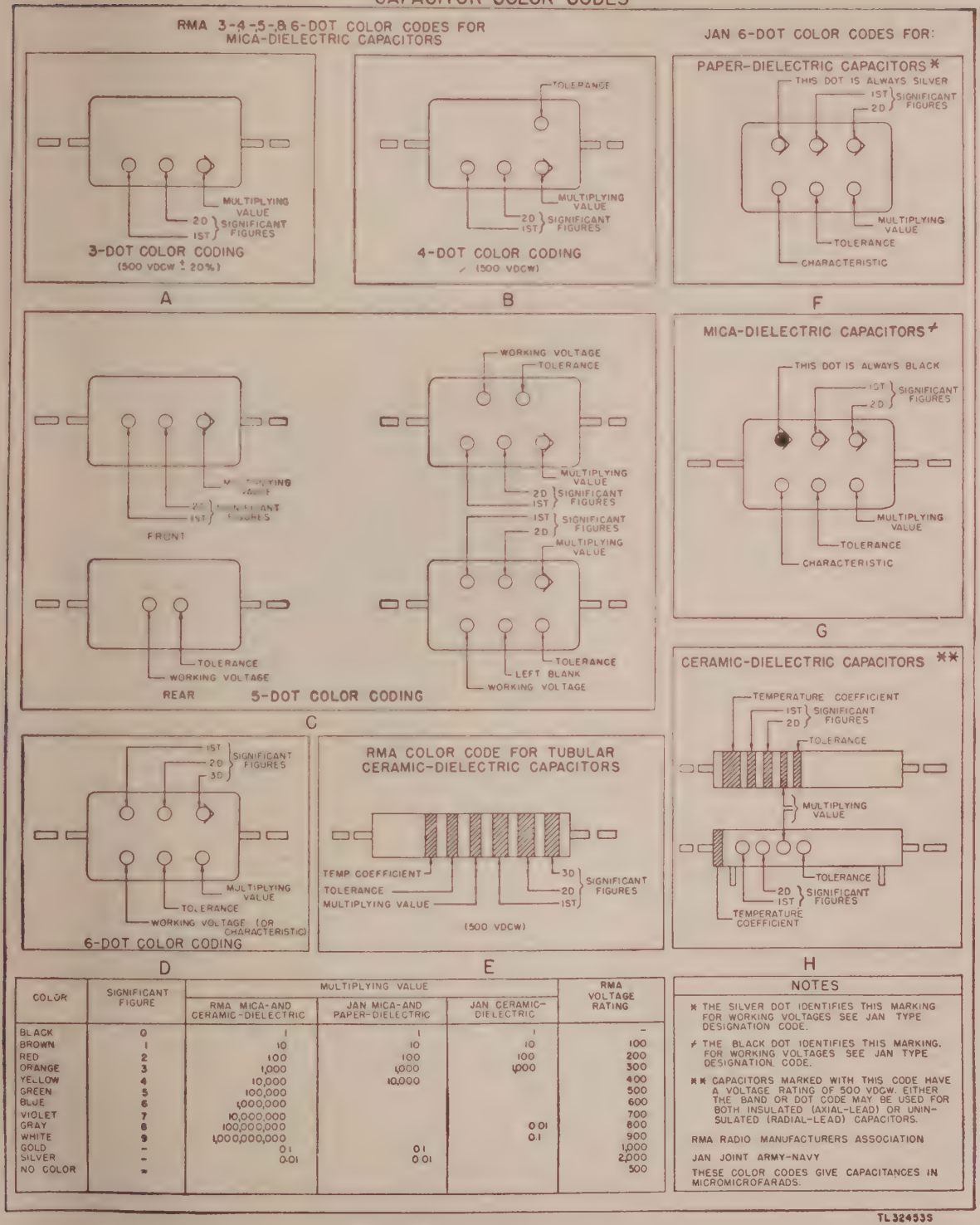
THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

TL 32454S

Figure 51. Resistor color code.

CAPACITOR COLOR CODES



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	-
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	-	0.1	0.1		1,000
SILVER	-	0.01	0.01		2,000
NO COLOR	-				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

≠ THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS.

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JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

TL 32453S

Figure 52. Capacitor color code.

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